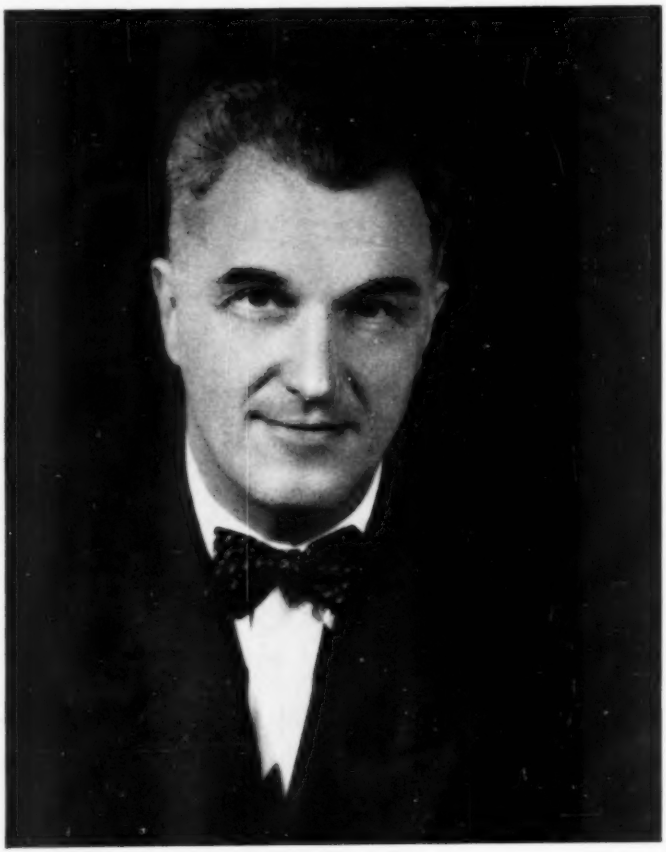
VOLUME XXXVII NO. 193 JULY-AUGUST 1952

LAND SEA AIR ORDNANCE



DR. G. P. HARNWELL
Chairman, Ordnance Committee, Research and Development Board

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★ Blueprint to Beachhead . . . . . R. T. Keller
★ Ordnance at West Point . . . . . Col. J. D. Billingsley
★ Military Socialism . . . . . Robert W. Johnson

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The Magazine of Scientific and Industrial Preparedness

Vol. XXXVII JULY-AUGUST, 1952 No. 193

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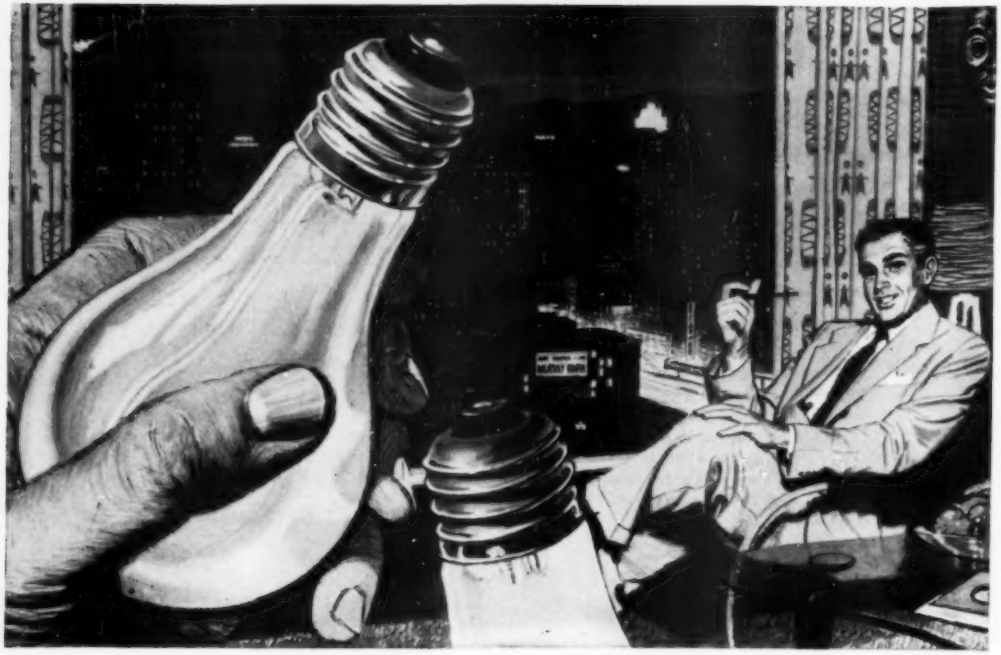

Small Change adds up to Millions

Perhaps you've noticed that lamp bases, traditionally made of brass, now are being made of aluminum. There's a story behind this change and it tells a lot about the kind of jobs going on at Alcoa.

It started several years ago when engineers of two leading lamp manufacturers agreed with our suggestion that bases of aluminum would cost less. "But will they be as good . . . will we have to revise our methods?" they asked.

The potential savings, a few mills per lamp times the 830 million sold each year, made finding the answers worth-while. Together we started two long-range research projects. One, to test aluminum alloys in the weather, fumes and years of standing idle that lamps must endure. The other, to find the alloy that would take five progressive draws, then thread rolling and finally, the high temperature of the red-hot glass that is poured in the base.

We tested samples, changed alloys, varied tempers, rolled different thicknesses. Lamp manufacturers tried each, until one met all requirements. Our development men worked long hours to get the right solder and flux to join the side wire to the base. Adapted them to the high-speed, lamp-making machines.

All this time, the manufacturers had aluminum bases installed in seacoast and industrial atmospheres. Our laboratories ran other tests on lit and unlit lamps under corrosive conditions. After 1½ years the reports came in: Aluminum bases measured up in every respect: conductivity, corrosion resistance, ease of installation and removal.

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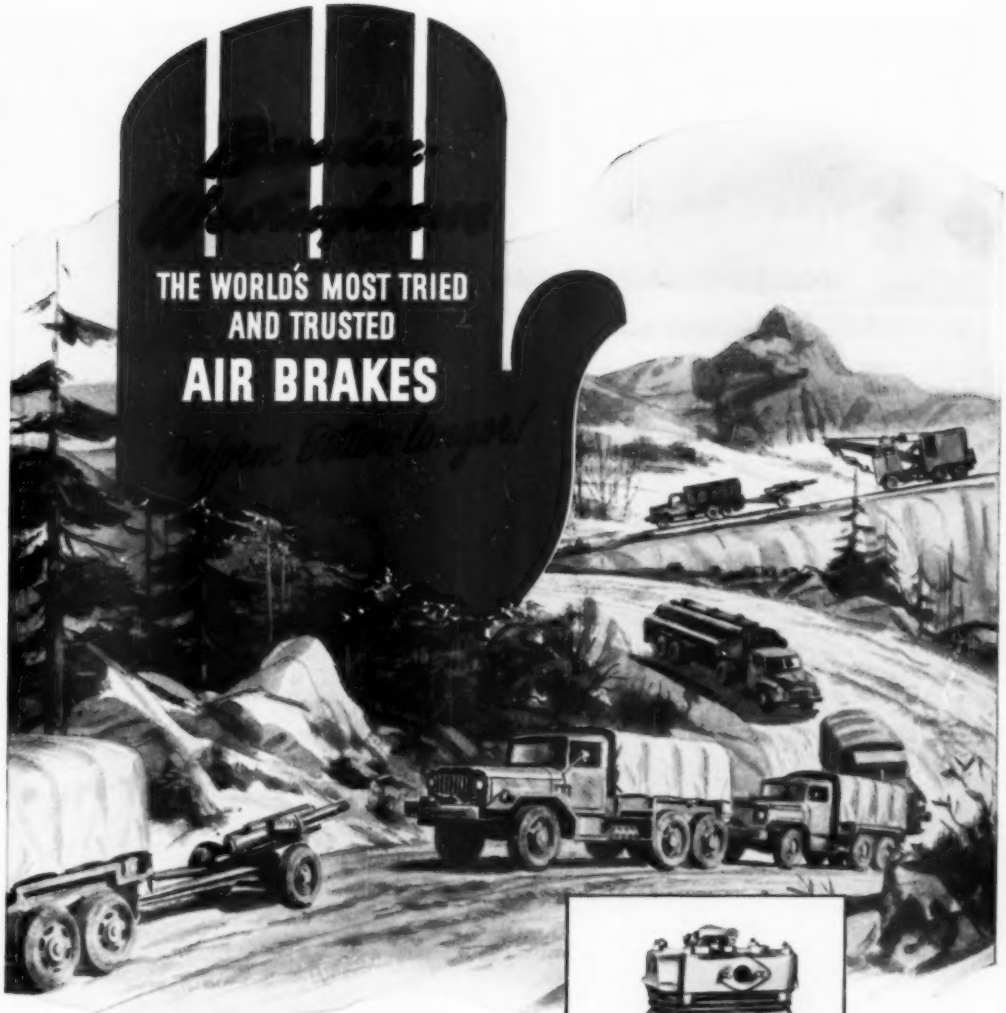

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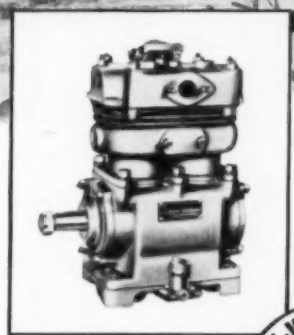

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"As men may be protected against
murder, but cannot be guarded against
suicide, so government may be shielded from
the assaults of external foes, but nothing can save
it when it chooses to lay violent hands on itself."

Daniel Webster

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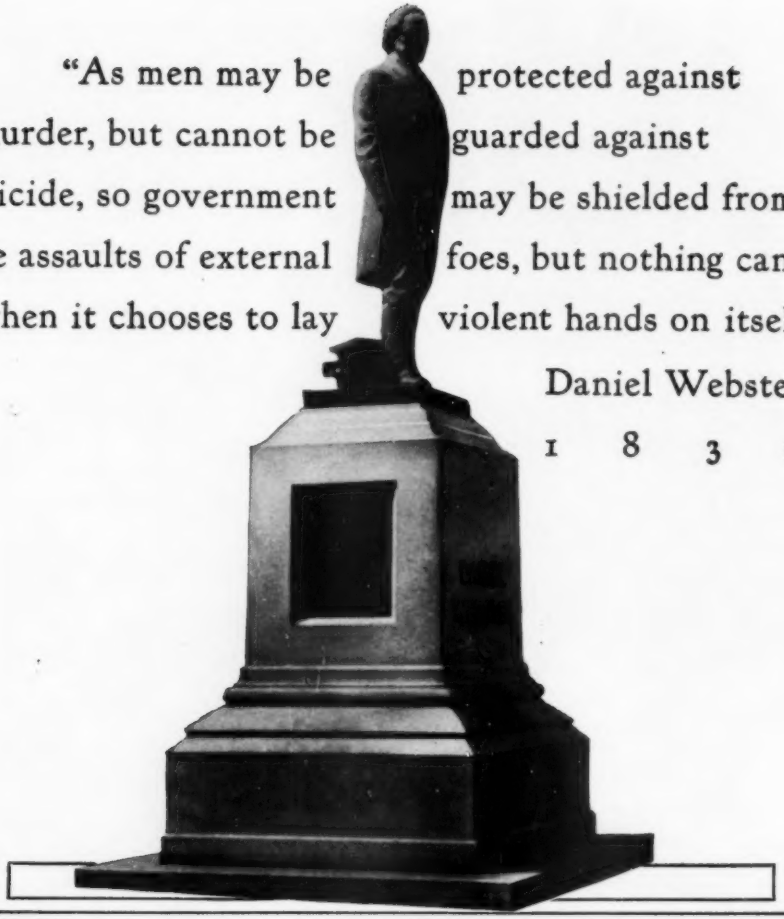

Like many of the early statesmen who helped make America great, Senator Webster recognized failings that might endanger our country long after his own time.

Today America is strong and getting stronger. We have proved time and again that we can handle "external foes." But corruption in high places, and the resulting scandals, can do more harm than foreign aggression. If we are to remain the greatest of nations we must clean up our own back yard . . . rid ourselves of the parasites and incapable persons who do harm from within. Then and only then will all of us — labor, management and government alike — benefit from living and working in the United States. Then and only then can America work out its destiny.

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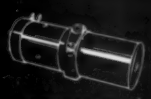

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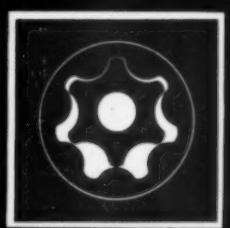

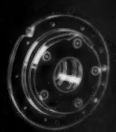

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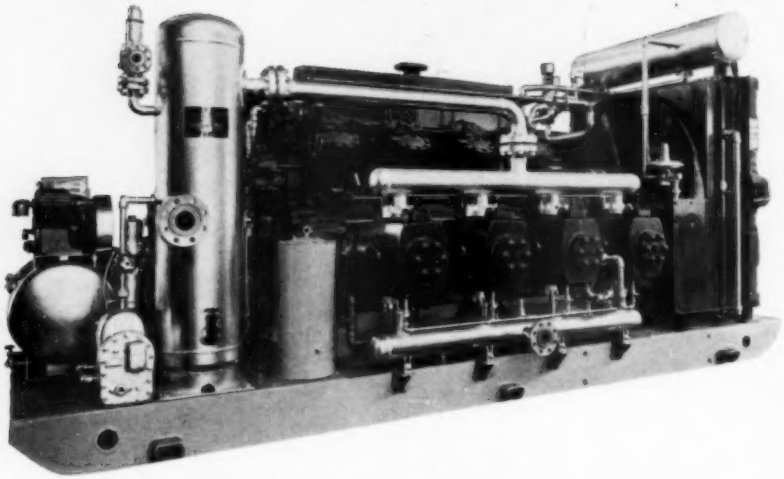

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AS A DOWEL . . . Rollpin is used here to prevent rotation of a thrust bearing. No reaming, no special locking. Easily removed. Lowest possible dowel pin cost.

AS A CLEVIS PIN . . . here Rollpin holds firmly in clevis, permits free action of moving member. Rollpin application above is with the plate of a home workshop tool.

AS A KEY . . . Rollpin demonstrates its ability to do away with precision tolerances, in this heating system damper arm. Faster, cheaper and more satisfactory than usual assemblies.

AS A STOP PIN . . . in this application, Rollpin is shown in a ratchet wrench adaptor. With its light weight and high shear strength, Rollpin functions perfectly . . . cuts assembly costs.

AS A SIMPLE FASTENER . . . Rollpin replaces a set screw in pinning a gear to a shaft. Assembly time is shorter, service life longer. Vibration-proof flush fit. Easily removable.

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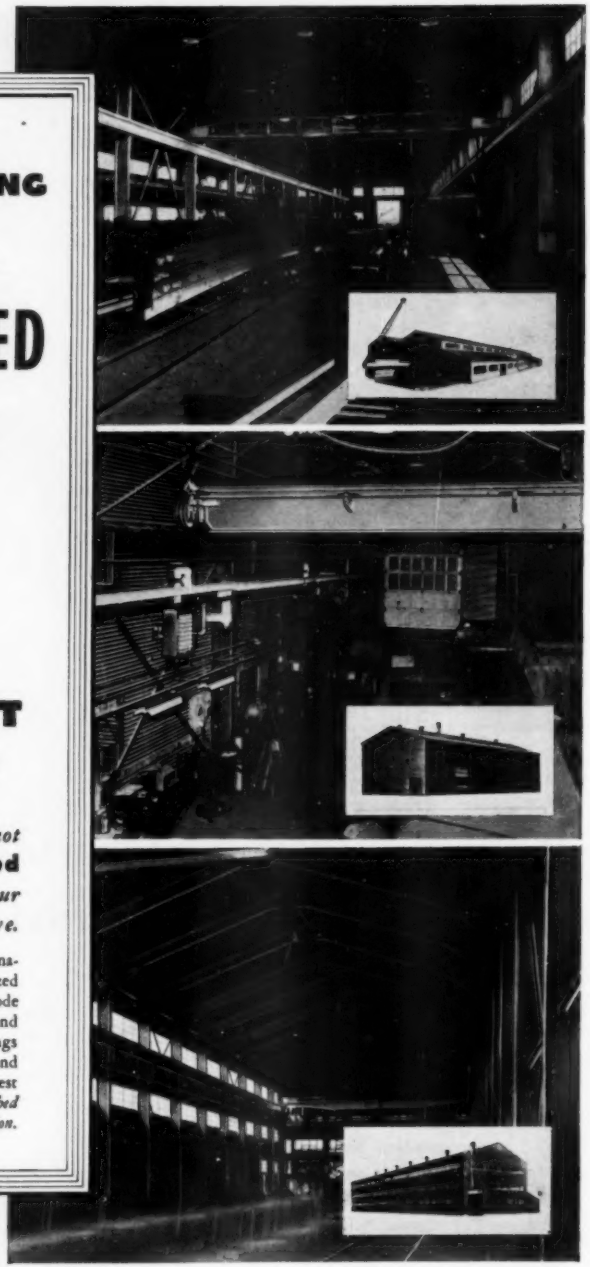

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In quest of the "skeleton of speech"

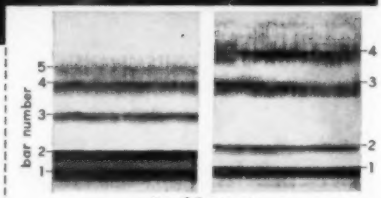
In the famous Quiet Room at Bell Laboratories, this young volunteer records speech for analysis. Scientists seek to isolate the frequencies and intensities which give meaning to words . . . stripping away non-essential parts of word sounds to get the basic "skeleton" of speech.

A child or an adult . . . a man or a woman . . . an American or an Englishman—all speak a certain word. Their voices differ greatly. Yet listeners understand the word at once. What are the common factors in speech which convey this information to the hearer's brain?

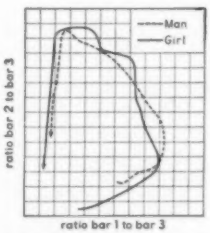
Bell scientists are searching for the key. Once discovered, it could lead to new electrical systems obedient in new ways to the spoken word, saving time and money in telephony.

Chief tool in the research is the sound spectrograph which Bell Telephone Laboratories developed to make speech visible. Many kinds of persons record their voices, each trying to duplicate an electrically produced "model" sound. While their voice patterns are studied, a parallel investigation is made of the way human vocal cords, mouth, nose and throat produce speech.

Thus, scientists at Bell Laboratories dig deeply into the fundamentals of the way people talk, so that tomorrow's telephone system may carry your voice still more efficiently—offering more value, keeping the cost low.



Spectrograms of young girl's voice (right) and man's voice making "uh" sound as in "up." Horizontal bars reveal frequencies in the vocal cavities at which energy is concentrated. The top of the picture is 6000 cycles per second. Pictures show how child's resonance bars are pitched higher than man's.



The word "five." Graph shows ratio of frequency of spectrogram bars. The solid line is for a girl and the dotted line is for a man. Note the similar patterns despite pitch differences. Human hearing extracts the speech sounds from this sort of pattern in the identification of words. Scientists aim at machines that can do the same.

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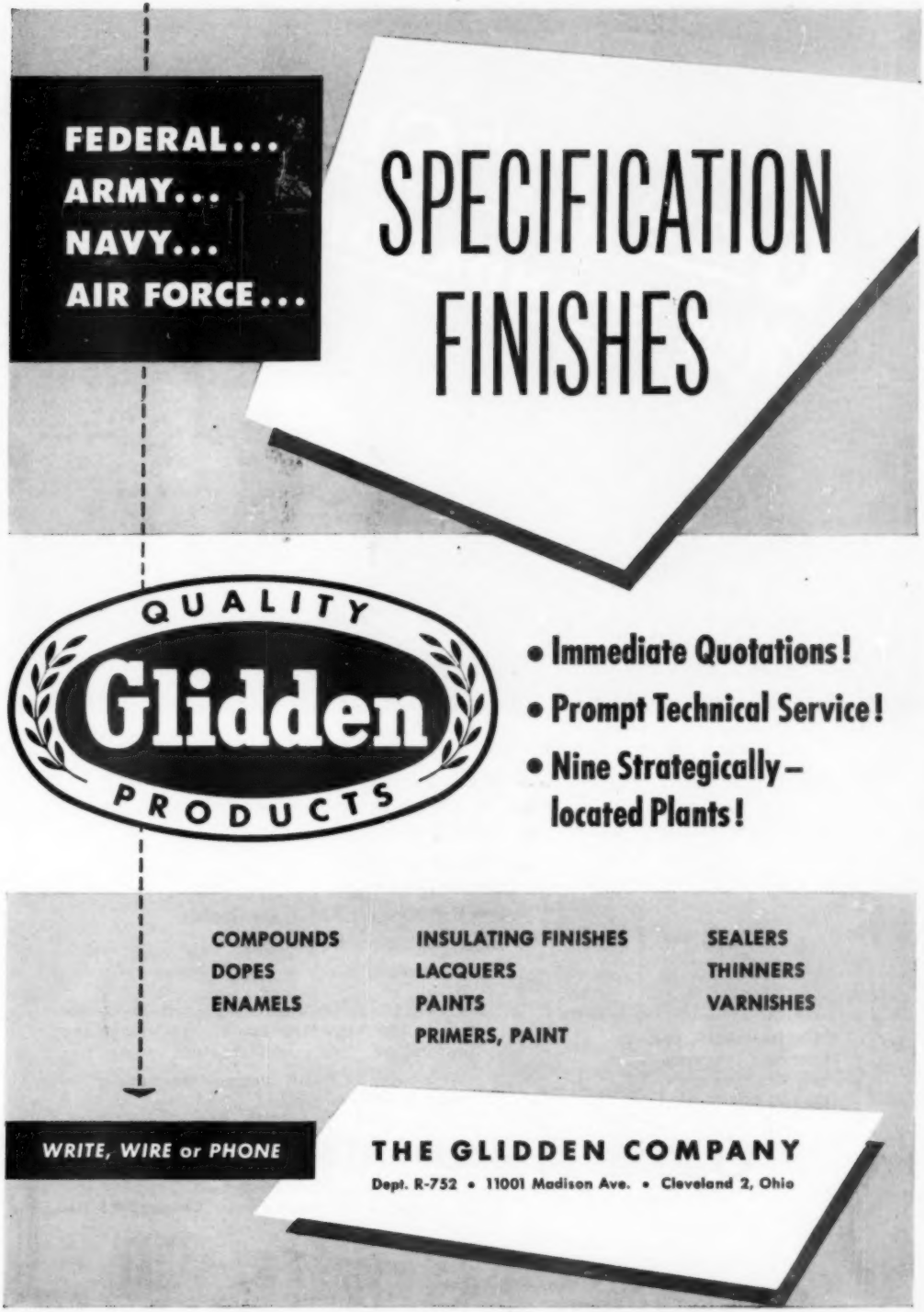
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1

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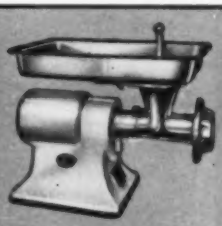
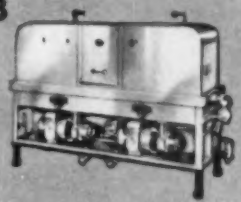
2



Speed Food Preparation—with Hobart Food Machines. Choppers, for instance, come in meat capacities up to 37 lbs. per minute. Peelers can peel up to 35 lbs. of potatoes in 1 to 3 minutes. Meat saws can cut 80% from hand cutting time. Slicers and food cutters speed production in kitchen and salad pantry alike. All Hobart products—*clean in design, clean in performance*—are ruggedly built, are on the job when you want them.

3



Mechanize the Dish Pantry. Work out a straight-through production line, with soiled dish table, racks, glasswashers, dish scrappers and dishwashers lined up for maximum output with minimum handling. Hobart makes dishwashers in all sizes, from under-counter models to 29-foot fully automatic, continuous-racking giants doing the entire job alone. All meet the same exacting sanitation standards.

That's it—your program for success today! Here at Hobart we make *all* the food and kitchen machines we've talked about, and more—most of them in a choice of sizes. Our products, our guarantee and our nation-wide service have more than half a century of experience behind them. There's Hobart representation near *you*—anxious to serve . . .

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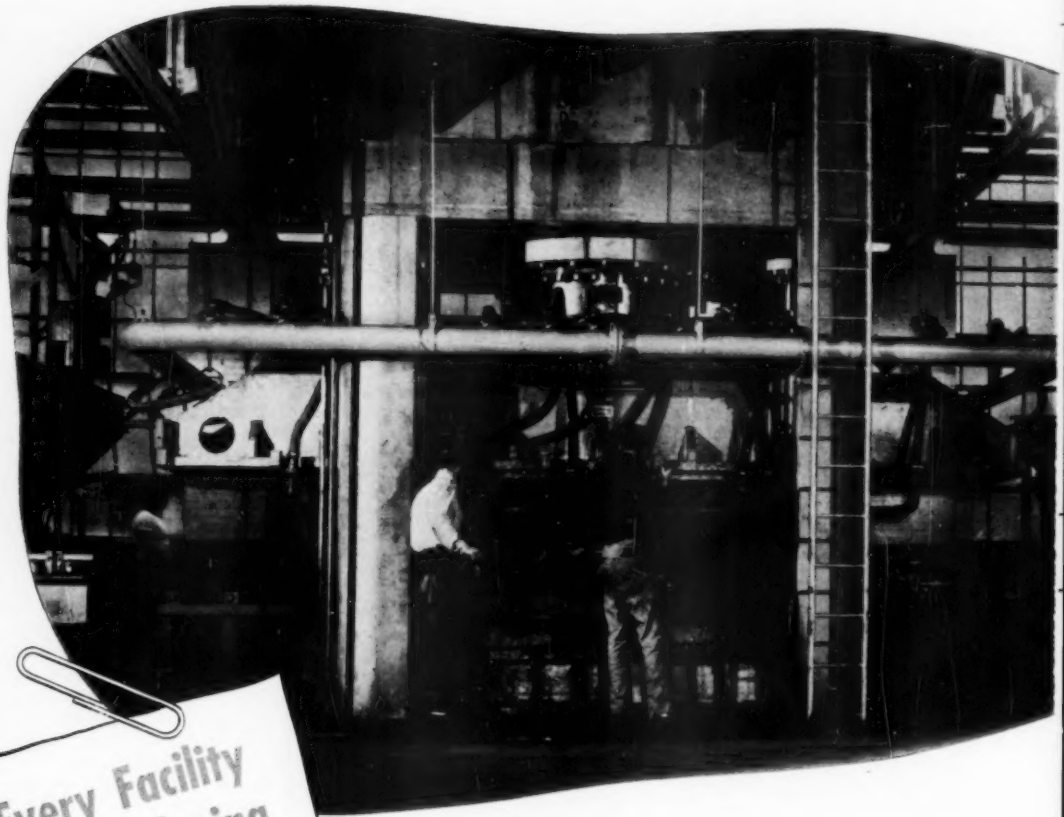

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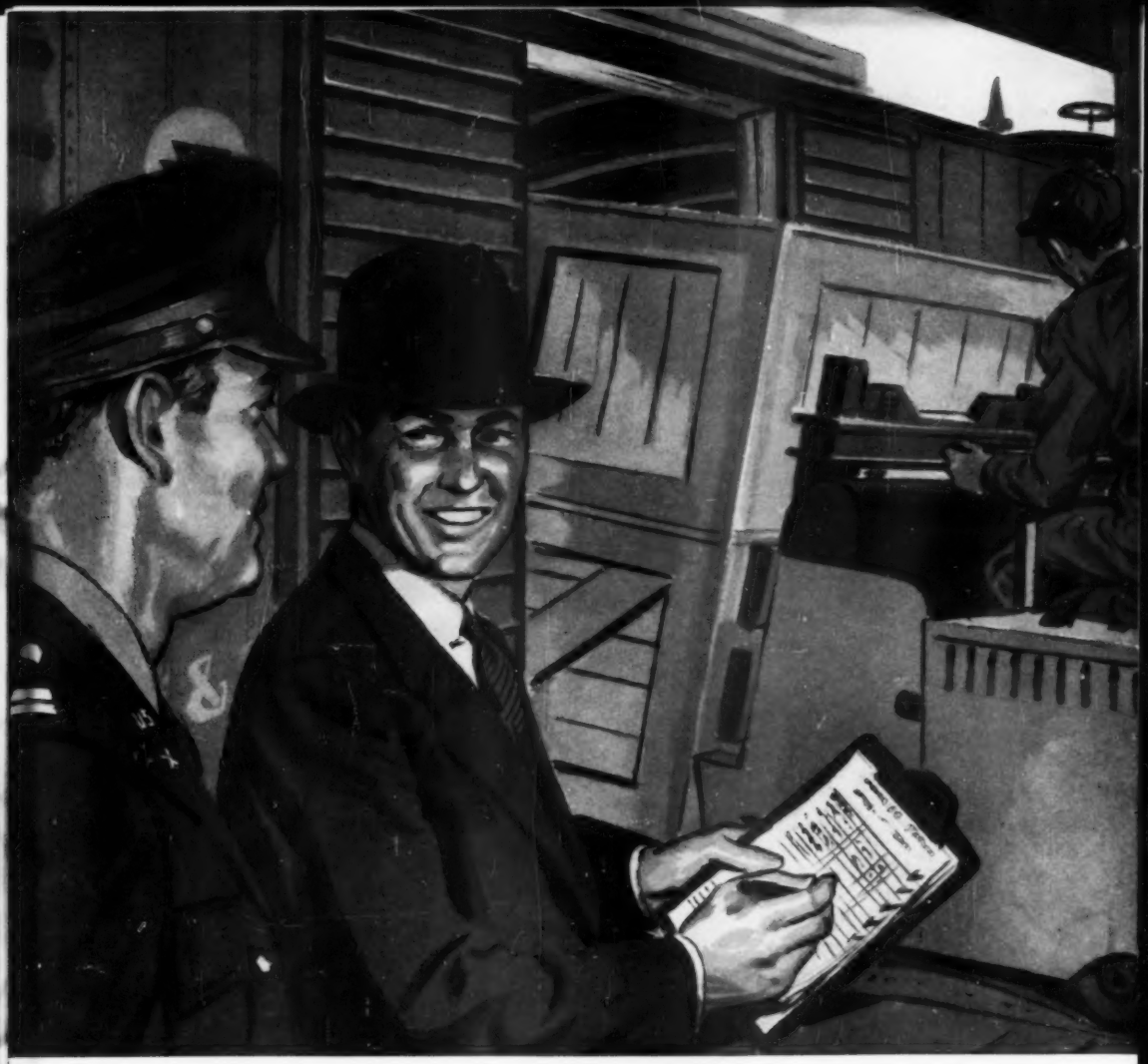

It's a full load

American business now carries one of the largest loads in its history as it works to fill orders for *both* industrial *and* defense requirements.

In today's semi-military economy, companies like American Locomotive carry on two separate operations to meet these dual needs.

From one Alco plant come modern diesel-electrics to help railroads handle traffic essential to both industrial strength and defense. In the same city, but from completely independent facilities, Alco's Ordnance Division turns out the Army's new medium tank with the aid of a network of 2000 subcontractors.

This side-by-side operation . . . typical of other American Locomotive Divisions producing essentials for both defense and industry . . . will help make America secure.

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Better cleaning cuts costs in aircraft production. This 48-page illustrated booklet outlines all the big cleaning jobs. Have you seen the latest Oakite recommendations on:

¶ How to clean aluminum in preparation for anodizing? *See page 4.*
¶ How to prepare aluminum for spot welding? gas welding? heliarc welding? *See pages 10 to 14.*
¶ How to remove welding flux? *See page 14.*
¶ How to prepare aluminum for painting? *See page 15.*
¶ How to clean aluminum before and after heat treating? *See page 20.*
¶ How to strip paint from aluminum? *See page 22.*
¶ How to clean magnesium? *See page 27.*
¶ How to select and install cleaning tanks, rinse tanks and sprays, and spray-washing machines? *See pages 31 to 35.*
¶ How to treat water in paint spray booths? *See page 36.*
¶ How to clean engine test cells? *See page 40.*

FREE Write for your copy of the booklet. You'll find added interest in the Oakite Aluminum-Cleaning Chart covering the cleaning, etching, de-smutting, de-oxidizing and pre-paint treatment for many alloys.

SPECIALIZED INDUSTRIAL CLEANING
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MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE PRODUCTS, INC.
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Send me a FREE copy of your booklet *"How to Clean Metals in Aircraft Production."*

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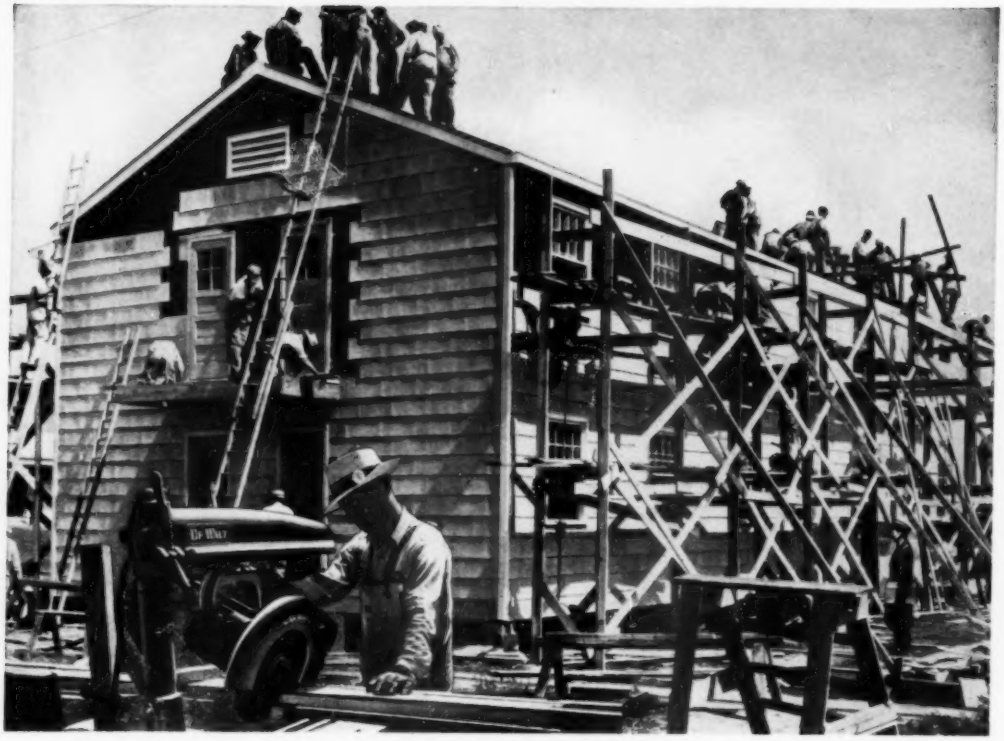

What it takes to house 3,500,000 men!

TIMBER
1,048,300,000 board ft.

STEEL
219,450 tons

ASPHALT SHINGLES
29,788,000 squares

CONCRETE
12,100,000 cu. yds.

DE WALT POWER SAWS
3500

Quickly translating these raw materials into training centers for our Armed Forces takes a special brand of *skill* and *speed* made possible by AMF-DeWalt Power Saws. Because these saws cut with such speed and precision, a builder can employ assembly-line methods to complete a barracks in less than 24 hours!

This amazing speed and precision have made DeWalts basic equipment in construction work of *all* types, in lumber yards, in industrial plants, in wood and metal working shops throughout the world. A DeWalt cuts everything—wood, metal, plastics, composition materials . . . and *costs!*

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1902 • 1952

50 YEARS OF QUALITY LEADERSHIP

You Can Place Full Confidence in the Product of the Manufacturer Who Has Chosen

as the Heart of His Machine

PARTS AND SERVICE EVERYWHERE

TODAY'S BROAD AND DIVERSIFIED LINE OF CONTINENTAL RED SEAL ENGINES INCLUDES SOME 80 BASIC MODELS, BUILT TO MORE THAN 2,000 DIFFERENT SPECIFICATIONS FOR COUNTLESS APPLICATIONS ON LAND, AT SEA AND IN THE AIR.

Continental Motors Corporation
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This Trade Mark

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ON ROCKETS • SHELLS • FUZES

and other ammunition metal components assures the armed forces of highest quality, delivery as promised and fair price.

HECO RESEARCH CENTER—
This new experimental and testing laboratory is located in South Denver, apart from the main plant.

Its alert staff and modern equipment will enable the company to broaden and increase its activity in ordnance research and development.

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Contractors to the United States Armed Forces for Rockets, Shells, Fuzes, Research and Development

For better insulation . . . weat
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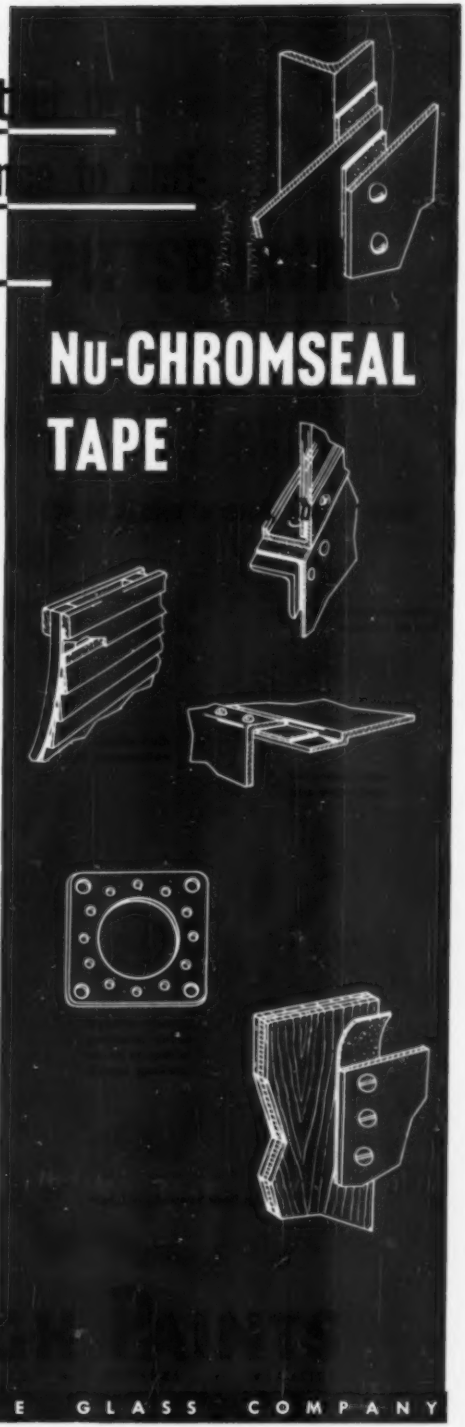

MORE AND MORE production executives in many industries are turning to Pittsburgh's Nu-Chromseal Tape to seal lap joints or butt seams in metal, wood or fiber, where rivets, bolts or screws are used.

● **Nu-Chromseal Tape** is a solid, pliable compound of fixed width and thickness of unusual versatility. It can be used for weatherproofing of roof and side panels of motor buses; for caulking around fender-to-body seams of motor cars; in various seams of marine craft, for sealing water, gasoline and oil storage tanks; and as a galvanic insulator between dissimilar metals to prevent corrosion. It is also an excellent anti-squeak or anti-chafe medium between wood or metal members which have a tendency to rub.

● **Nu-Chromseal** is gently adhesive so that it can be readily applied under rapid production conditions. It can be used on units where baking temperature runs as high as 375 degrees, without bleeding or materially changing in character. Its pliable consistency permits easy tailoring—excess material can be readily trimmed.

Pittsburgh also offers WELDSEAL and FABSEAL Tapes

● **Weldseal** Tape protects spot-welded and hot-riveted assemblies from corrosion by sealing seams against moisture.

● **Fabseal** Tape is an impregnated fabric that forms a complete seal between wood, metal or fiber members.

Samples of these remarkable tapes are available on request for experimental work. Our engineers will be glad to consult with you without charge or obligation.

PITTSBURGH PLATE GLASS COMPANY—Industrial Paint Division; Pittsburgh, Pa. Factories: Milwaukee, Wis.; Newark, N. J.; Springdale, Pa.; Atlanta, Ga.; Houston, Texas; Los Angeles, Calif.; Portland, Ore. Ditzler Color Division, Detroit, Michigan. The Thresher Paint & Varnish Co., Dayton, Ohio. Forbes Finishes Division, Cleveland, Ohio. M. B. Suydam Division, Pittsburgh, Pa.

PITTSBURG
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★★★★★ **for domestic or export shipment...**

★★★★★ **for light or heavy products...**

★★★★★ **for large or small objects...**

there's a General engineered shipping container to meet military packing needs!

Pictured here is a General Wirebound box for the export shipment of 50-caliber ammunition. It combines strength and light weight. It is one of many types made by General —to meet military needs. Remember General when you have a military packaging problem. Container experts will be glad to design a package for your product, or help you with various specifications.

Write for your FREE *Copy of "The General Box." It shows how to cut packing and shipping costs.*

DISTRICT OFFICES AND PLANTS: Cincinnati, Denville, N. J., Detroit, East St. Louis, Kansas City, Louisville, Milwaukee, Sheboygan, Winchendon, General Box Company of Mississippi, Meridian, Miss., Continental Box Company, Inc., Houston, Dallas

General ★★★★★ BOX COMPANY

GENERAL OFFICES: 1865 Miner Street, Des Plaines, Ill.

DO YOU KNOW THE BLAW-KNOX STORY?

Blaw-Knox occupies a unique position in industry. The scope of its products and services—some of which are shown here—is broad and comprehensive, while its specialized engineering knowledge is practically inexhaustible. The booklet, "Welcome to Blaw-Knox," tells our story pictorially. May we send you a copy?

BASIC PRODUCTS FOR INDUSTRY

- ROLLS FOR STEEL & NON-FERROUS MILLS
- ROLLING MILLS & AUXILIARY MACHINERY
- OPEN STEEL FLOORING
- PREFABRICATED PIPING SYSTEMS
- OPEN HEARTH FURNACE EQUIPMENT
- FIRE PROTECTION EQUIPMENT
- CHEMICAL & FOOD PROCESSING EQUIPMENT
- CONCRETE & ASPHALT ROAD PAVING MACHINERY
- COMPLETE CHEMICAL & PROCESSING PLANTS
- STANDARD STEEL BUILDINGS
- RADIO, TELEVISION & TRANSMISSION TOWERS
- HEAVY STEEL CASTINGS
- HEAT & CORROSION RESISTING ALLOY CASTINGS
- STEEL FORMS FOR CONCRETE CONSTRUCTION
- CONTRACTORS EQUIPMENT
- CLAMSHELL BUCKETS

RECENT CATALOGS AND BULLETINS detailing practically all Blaw-Knox products are available, and any literature you request will be forwarded by return mail.

OPERATING AND SALES DIVISIONS—BLAW-KNOX • BLAW-KNOX SPRINKLER* • BUFLOVAK EQUIPMENT • BUFLOVAK MIDWEST CO. • CHEMICAL PLANTS* • THE FOOTE COMPANY, INC.** • LEWIS FOUNDRY & MACHINE • NATIONAL ALLOY STEEL • PITTSBURGH ROLLS • POWER PIPING* • UNION STEEL CASTINGS

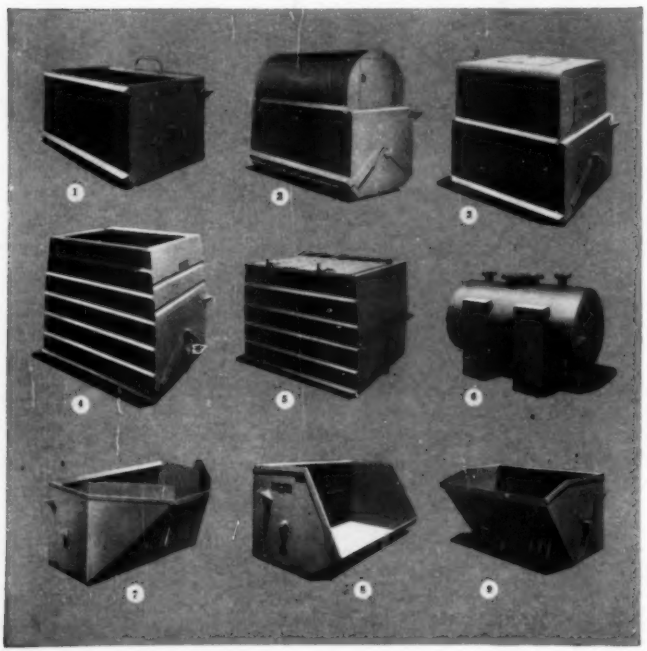
*Operates as a division of Blaw-Knox Construction Company

**Subsidiary of Blaw-Knox Company

*Awarded seven "E's" during World War II

BLAW-KNOX

One truck-mounted Dempster-Dumpster picks up, hauls and dumps all detachable containers, one after another, regardless of size or design. This typical operation cycle, shown above, is handled by only one man, the driver, in less than 90 seconds by means of hydraulic controls in truck cab.



1—Cuts Cost of Equipment and Operation— It is not unusual for one Dempster-Dumpster to perform the work of from 3 to 5 conventional trucks . . . reducing investment accordingly. Eliminating trucks also means eliminating tires, gas, oil, maintenance and man hours.

3—Eliminates Re-Handling of Materials — Re-handling of materials, which by conventional methods are hand loaded by loading crews into dump trucks, is eliminated. Each detachable container remains at its convenient location until loaded. Then, in less than a minute, it is picked up by Dempster-Dumpster and taken to destination. There it is dumped or set down intact . . . saving hundreds of man hours annually.

• • •

At left are a few standard containers for general requirements—1—Drop Bottom Container built up to 10 cu. yd. capacity to handle heavy materials. 2—Apartment Type for bulk trash and rubbish with sump bottom for handling moist materials. 3—Universal Type available with top and end doors. 4—Drop Bottom Pressed Steel Type for lighter service. 5—Drop Bottom Pressed Steel Type with counterbalanced spring lids. 6—Tank Type Container meeting A.S.M.E. specifications. Capacities up to 1,200 gallons. 7—Tilt Type with Converged Lip for handling fine aggregate, wet or fluid materials. 8—Skip Type with Lip to assist in holding certain types of loaded materials in place. 9—Tilt Type for handling heavy materials. Built water-tight.

DEMPSTER BROTHERS

MOST EFFICIENT METHOD OF MATERIALS HANDLING BY TRUCK EVER DEVISED

If you collect and move bulky, light or heavy materials in your plant operation . . . be they solid, liquid, dust, rubbish or waste, the Dempster-Dumpster System merits your careful consideration and investigation. This revolutionary method of bulk materials handling by truck can save you thousands of dollars annually!

The fundamental reason why the Dempster-Dumpster System is the most efficient method of materials handling by truck is because, in this system, one truck serves scores of detachable containers. In other words, a truck-mounted Dempster-Dumpster . . . with only one man, the driver . . . picks up, hauls, dumps or sets down intact . . . one after another . . . any required number of big Dempster-Dumpster Containers.

The hydraulically operated Dempster-Dumpster is mounted on any make truck chassis of suitable size.

The steel containers are available in a wide variety of designs best suited to the type of materials handled—be they bulky, light or heavy . . . solids, liquids or dust . . . trash or rubbish. They range in size up to more than three times the capacity of the average dump truck body. The containers are spotted inside and outside your plant at convenient materials accumulation points. A few of the dozens of detachable containers are shown here so that you may see the flexibility of this system in handling all types of materials in your plant with one truck. It may be that none of these containers will fit your own particular need. But remember there are Dempster-Dumpster Containers that will, either standard or special design.

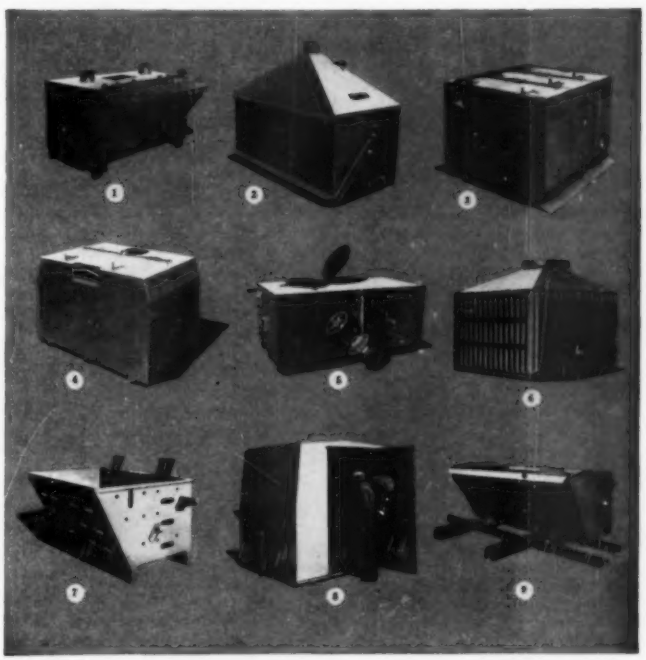
More efficient and lower cost materials handling in your plant may be simply a matter of getting the probing minds of your engineers and ours together. Our files contain hundreds of inquiring letters that ultimately resulted in savings of thousands of dollars annually in every conceivable type of manufacturing plant. A discussion with our engineers might develop the same results for you. If advisable, they will be glad to make, without obligation on your part, a proper survey to determine just what equipment you may need. The Dempster-Dumpster System is manufactured exclusively by Dempster Brothers, Inc.

2—Eliminates Standing Idle Time—One man, the truck driver, replaces truck loading crew. Detachable containers are pre-loaded through normal accumulation. Truck-mounted Dempster-Dumpster and driver never stand idle because there is always a pre-loaded detachable container to be serviced.

4—Increases Efficiency, Sanitation and Good "Housekeeping"—The Demp-Dumpster System is a complete, unified plan for area-wide materials handling. Materials to be disposed of or transferred are placed in a nearby container as they accumulate. Containers used for trash and rubbish are fire-proof, rat-proof and fly-proof. No other method of materials handling by truck can match the Dempster-Dumpster System in efficiency and low operating cost!

• • •

At right are a few containers built for special requirements— 1—Five cu. yd. container with swivel casters for handling waste blast sand. 2—Three cu. yd. Dust Collector Type equipped with gaskets. 3—Multi-Karry Container equipped with three 2 cu. yd. steel boxes with casters and lids. 4—Six cu. yd. drop bottom container with two spring-hinged lids and special loading opening in top. 5—Rectangular Tank Type Container with gate valve and gasketed Lid. 6—Chlorinator Ash Container designed for handling hot residue approximately 1500° F. 7—Tilt Type Container built for cast linings for handling hot materials. 8—One of several special "Tool and Equipment" Type Containers. 9—One of several types of special built containers equipped with ball bearing trucks.



972 Shea Building, Knoxville 17, Tennessee

A "CLOUDBURST" in this water tunnel proves the effectiveness of Chrysler Corporation's advanced methods of sealing against moisture, dust and drafts. Here complete De Soto bodies pass high-pressure water jets that douse them from every angle. This is typical of the thoroughness with which all Chrysler Corporation cars are built.

A CAR'S BODY TELLS A LOT ABOUT A CAR'S REAL WORTH TO YOU

Chrysler Corporation engineers, stylists, and production men work together, so that body and chassis form a perfectly balanced unit—created from the start for your safety, comfort and *driving and handling ease.*

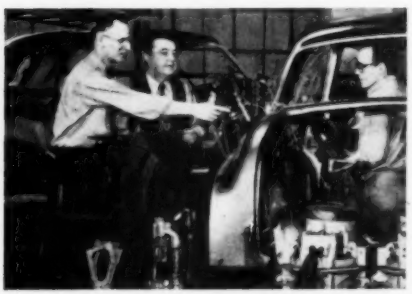
The way a door latches and holds . . . the amount of head and leg room you get . . . the comfort of the seats . . . breadth of vision . . . ease of getting in and out—all these are easily read guides to car worth.

In a Plymouth, Dodge, De Soto or Chrysler, you get a superior body—and a superior chassis—engineered to give you the greatest worth for your money.

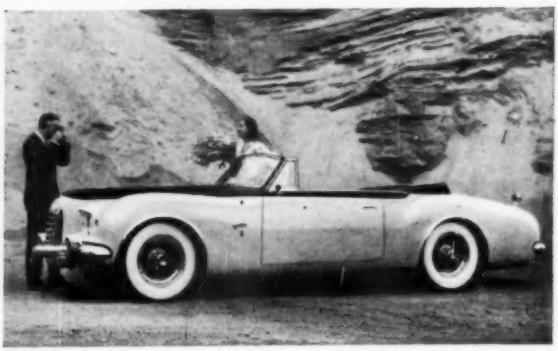
You can prove this for yourself just by calling your nearby dealer and driving one of these great cars.

CHRYSLER CORPORATION engineers and builds PLYMOUTH, DODGE, DE SOTO, CHRYSLER CARS & DODGE TRUCKS

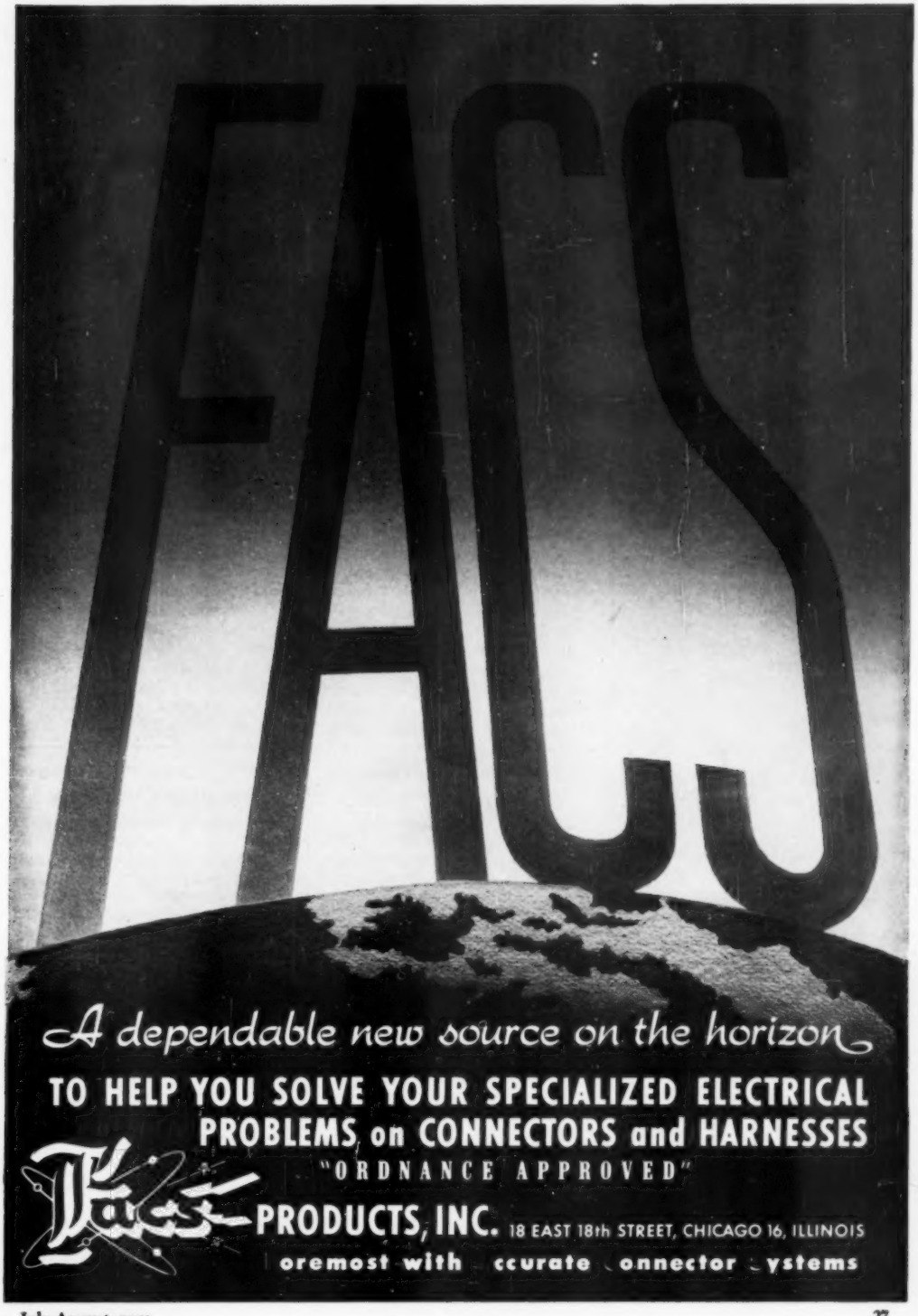
Chrysler Marine & Industrial Engines • **Oilite** Powdered Metal Products • **Mopar** Parts & Accessories
Airtemp Heating, Air Conditioning, Refrigeration • **Cycleweld** Cement Products



ENGINEERS' EYES ARE EVERYWHERE. Out of their laboratories and on to the production lines go Chrysler Corporation engineers, to follow through each step in body construction. Here an engineer studies the double welding of a Dodge body, one of the many things that mean safer and quieter cars, with windows that work easily, doors and panels that stay solid and free from rattles.



THE NEW C-200. New advanced body designs are created by Chrysler to learn from experience practical applications of entirely new concepts of style and comfort, fabrics and fittings, performance and safety. The Chrysler C-200 is the prototype of a dramatic new convertible.


FACS
A dependable new source on the horizon
TO HELP YOU SOLVE YOUR SPECIALIZED ELECTRICAL PROBLEMS on CONNECTORS and HARNESSES
"ORDNANCE APPROVED"
PRODUCTS, INC. 18 EAST 18th STREET, CHICAGO 16, ILLINOIS
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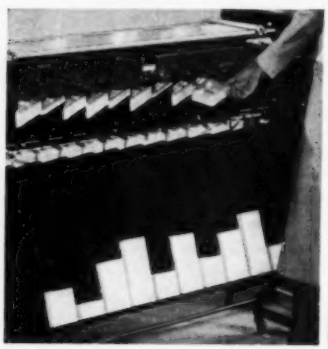
Remington Rand Methods News

HOW "FACT-POWER" CAN BOOST YOUR PLANT'S OPERATING EFFICIENCY

Does your COSTING cost you too much?

Cost accounting can be costly indeed if your reports are late, incomplete, inaccurate, or consuming too much clerical time in gathering and analysis of data.

Let us show you how one plant, with little extra effort, gets complete distribution of all direct and indirect labor. This includes guaranteed and idle time on each job. Their prompt job reports show labor, material, burden, total cost, and the difference between actual and standard costs. Other by-products of their profitable punched-card methods are: rework and spoilage report by employee; improved control of materials inventory; faster payrolls with bonus earnings. Ask for illustrated case history folder SN-779.



Costing in smaller plants. "A year ago," reports an executive, "we thought our plant was too small for punched-card labor distribution. But we were running six weeks behind on the manual cost reports for the output of our 150 plant employees. So we were glad to learn about Record Sort, the *simplified* Remington Rand punched-card method. Now we get labor distribution reports promptly on each production run—with a breakdown for each operation and each part number in the run. Also, by adapting this method to sales analysis, we get prompt reports on our hard-to-control LCL shipping costs."

See for yourself how simply this low-cost Record Sort method can be applied in small to medium plants. Ask for a slide film demonstration in your office, as well as folder TM-616.

Goodby to brass tool checks! "For years," reports a foreman, "we had trouble with old-fashioned brass tool checks. They would get knocked off their hooks and mixed up. Or the hurried attendant would return a check with wrong employee number on it. Now we have a Remington Rand visible system which double-checks itself to prevent errors. Each tool center can keep its records easily and accurately, relieving General Stores of the paperwork. What's more, this foolproof system guards against a shortage or overstock on any tool." Let us show you simple methods of tool crib control to reduce your tool costs and save the valuable time of both productive and non-productive employees. Ask for folder KD-641.

Tackling the problem of payroll peaks

There's one firm we know which has practically wiped out overtime and cut by half the lapsed time for payroll processing. To do this, they spent years developing better procedures and a smoother work flow.

During this careful study, Remington Rand payroll machines were chosen to replace others previously used. They said the machine features which greatly influenced the choice were: 1) complete visibility of the writing line as a great aid to speed; 2) ability to get all the column accumulations needed on each payroll; 3) versatility permitting use of machines for different services; 4) single-keyboard simplicity which enabled them to make competent operators quickly out of typists, without long and costly specialized training.

Let us show you more reasons why Remington Rand machines produce cash or check payrolls faster. Ask for folders AB-446 and AB-525.

20% slash in costs for plant upkeep

According to NY Times, a top industrial consultant says that proper planning and scheduling of preventive maintenance work may lead to savings of as much as 20 per cent on your overall costs for plant upkeep. If this kind of talk makes you want to hear more, let us show you how we have helped many plants reduce costly machine breakdowns as well as lower their costs.

Make a brief but profitable study of the preventive maintenance records and procedures used by ten well-known industrial firms. Ask for a ten-day loan of our case history file MC-727, and for your copy of new folder KD-705.

For information, please request literature by number. Call our Business Equipment Center in your city, or write to our Management Controls Reference Library, Room 1227, 315 Fourth Avenue, New York 10, N. Y.

Look for ideas from the Remington Rand Management Controls Reference Library

Average diameter of a hole
Bearing race matching
Angle between bore and face
Diameter
Thickness
Bore center distance
Crank throw, eliminating all error due to diametral tolerance
Twist
Bend
Typical Dimensions and Relationships measured with
Lobing or cloverleaf of a centerless ground shaft
Internal radial clearance
Flatness
Distance between hole centers eliminating all error caused by diametral tolerance
Center distance of incomplete holes eliminating all error caused by diametral tolerance
Sheffield
SHEFFIELD

60

WIREBOUND BOX PLANTS

are ready to serve you!

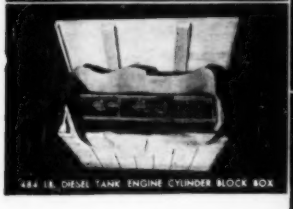
ALL FULLY INFORMED ON SPECIFICATIONS
AND REQUIREMENTS OF ALL GOVERNMENT BRANCHES

Strategically located to serve suppliers of all government services, Wirebound Box manufacturers are in excellent position to meet your shipping container needs. Parts boxes, equipment crates, over-packs and food containers are but a few of the multitude of uses for which Wirebound containers are adaptable. Wirebound manufacturers are informed, experienced and technically trained to design, produce and pre-test scientific containers for each use. Make it a point to consult your nearest Wirebound supplier or write for full information.

Wirebound Box Manufacturers Association
Room 1163, 327 South LaSalle Street, Chicago 4, Illinois

CYLINDER BOX

IMMERSION HEATER BOX


484 I.R. DIESEL TANK ENGINE CYLINDER BLOCK BOX

FIELD RANGE CRATE

CHEMICAL BOMB BOX

TYPICAL [illegible] OVERPACK

PROJECTILE BOX

PRACTICE BOMB CRATE

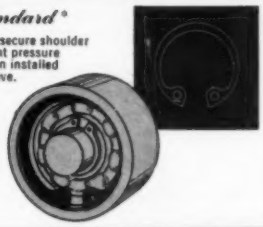
Wirebound
BOXES & CRATES
User's names on request

Speed Production, save material and machining operations with Waldes Truarc Retaining Rings

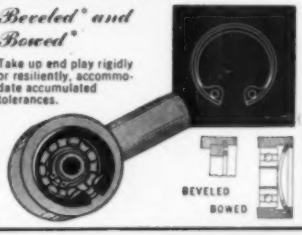
better way to hold parts together

THERE'S A TRUARC RING FOR EVERY PURPOSE

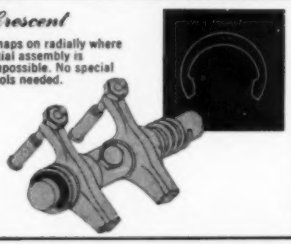
Standard* — Forms secure shoulder for tight pressure fit when installed in groove.



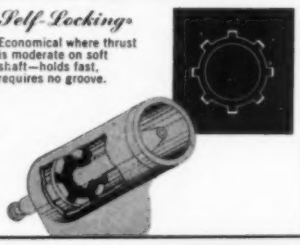
Beveled* and Bowed* — Take up end play rigidly or resiliently, accommodate accumulated tolerances.



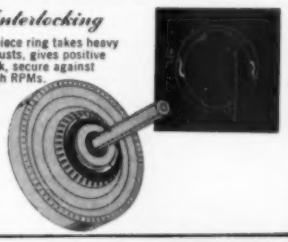
Crescent — Snaps on radially where axial assembly is impossible. No special tools needed.



Self-Locking* — Economical where thrust is moderate on soft shaft—holds fast, requires no groove.

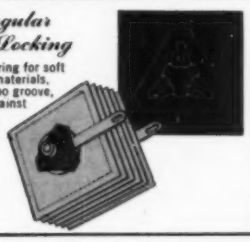


Interlocking — 2-piece ring takes heavy thrusts, gives positive lock, secure against high RPMs.



Inverted* — Provides uniform shoulder for curved abutting surfaces, for bearings with large corner radii.

Triangular Self-Locking — Low cost ring for soft shafting materials, requires no groove, secure against vibration.



E-Ring — Provides large strong shoulder for small shaft. Applied radially.

*BOTH INTERNAL AND EXTERNAL TYPES AVAILABLE

Thousands of smart manufacturers are *stepping up* production, while actually *cutting* costs—with Waldes Truarc Retaining Rings! Truarc Rings simplify your designs. The ease with which they can be assembled and disassembled makes them superior in many fastening applications where machined shoulders, nuts, bolts, snap rings or cotter pins have been used.

Waldes Truarc Rings eliminate threading, milling and other skilled labor operations... save on material. And there's a Truarc Ring for every purpose... precision-engineered to conform to the highest NAS and SAE standards!

Waldes Truarc Rings are nationally distributed and stocked. Send us your drawings. Waldes Truarc engineers will give your problem individual attention, without obligation.

WALDES

TRUARC

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RETAINING RINGS

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WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 2,382,947; 2,382,948; 2,410,892; 2,420,921; 2,420,341; 2,420,709; 2,441,600; 2,455,103; 2,483,300; 2,483,303; 2,487,002; 2,487,003; 2,491,306; 2,509,081 AND OTHER PATENTS PENDING.

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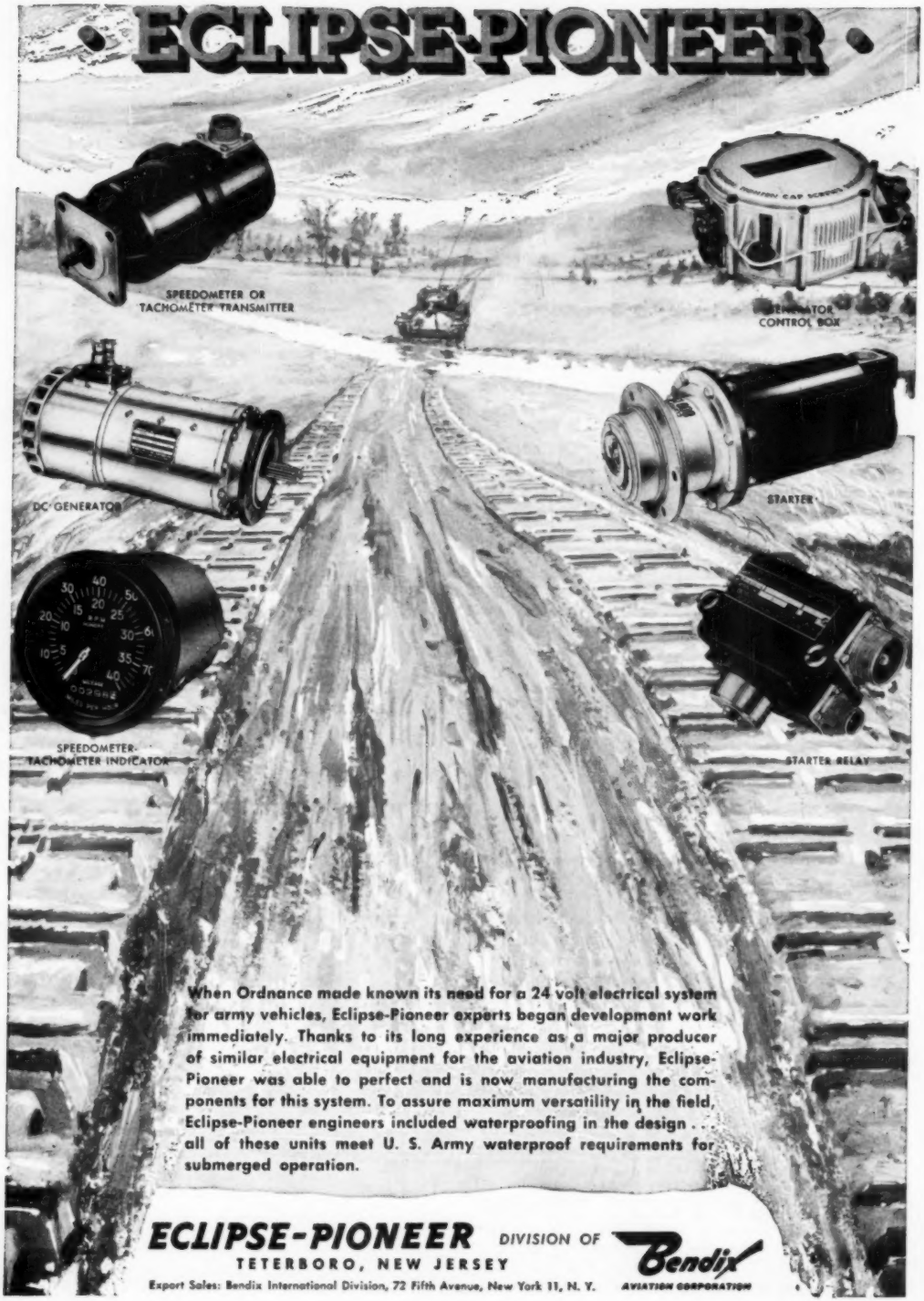
The same precision production facilities which have turned out millions of Truarc Rings to the most exacting specifications are available to handle sub-contracting of metal stampings. Write directly to Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N.Y.

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, N. Y. • MAKERS OF FAMOUS, PRECISION-ENGINEERED WALDES SLIDE FASTENERS AND SNAP FASTENERS

ECLIPSE-PIONEER



When Ordnance made known its need for a 24 volt electrical system for army vehicles, Eclipse-Pioneer experts began development work immediately. Thanks to its long experience as a major producer of similar electrical equipment for the aviation industry, Eclipse-Pioneer was able to perfect and is now manufacturing the components for this system. To assure maximum versatility in the field, Eclipse-Pioneer engineers included waterproofing in the design . . . all of these units meet U. S. Army waterproof requirements for submerged operation.

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Spicer

SPECIALISTS IN SERVICE

ARCHIMEDES SAID:

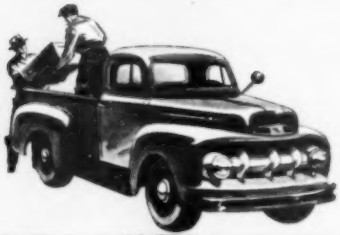
"Give me enough leverage and I will move the world"

Today, the world is moved through the efficiency of Spicer power transmission equipment, performing constructive service in all fields of automobile, truck, bus, tractor and railway car duty.

More Spicer Universal Joints are in use on a greater variety of installations than any make. And Spicer Universal Joints have behind them a longer record of service and experience than any other similar unit. Since 1904, Spicer products have been the Standard of the Industry.

Spicer

SPECIALISTS IN SERVICE



Half-ton or Multi-ton

... every truck service need is met by Spicer Universal Joint Design

Speedy, light-delivery jobs... or dead-weight tonnage involving the world's heaviest loads... every extreme and type of truck service requirement is met by adequate engineering design in Spicer flange- and yoke-type models.

- Sliding splines have ground finish on ALL contact surfaces, extra hardness, and iron manganese phosphate coating.
- True bearing alignment with rigid one-piece yoke design. This *rigidity* is the essence of accuracy.
- Precision bearings with improved surface hardness and finish.
- Dynamically balanced to exacting limits.
- Uniform high quality propeller shaft tubing. *Steel meets our special specifications.*
- Wide selection of flange and yoke types and sizes to suit each individual requirement.

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are worth knowing about

WHAT metal is best for bearings? For diaphragms? For *any* tough production job that requires a metal of superior qualities? Chase Phosphor Bronzes may be the answer.

These tin bronzes are superior to many other metals for a wide variety of functions. Some Chase Phosphor Bronzes are ideal for fuse clips, spring contacts, bellows, lock washers. Others are suited for bearings, bushings, gears, pinions, screw machine parts. They are made in Rod, Strip or Wire.

Chase Phosphor Bronzes... like all Chase metals... are carefully controlled as to quality to provide a high standard of surface finish and excellent internal characteristics. Fill in the coupon below and we'll send you the free Chase folder.

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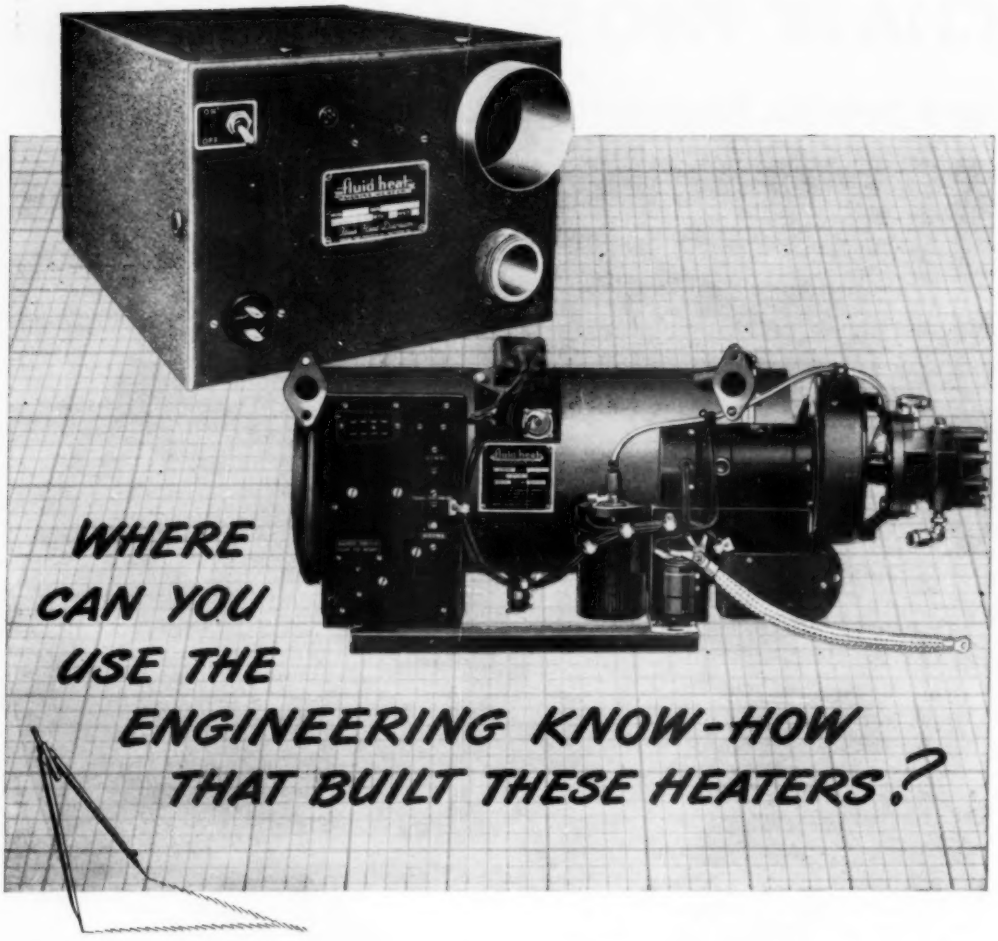

FLUID HEAT ENGINEERING KNOW-HOW has produced compact, independently operated space heaters for trucks, boats and tanks that faithfully put forth from 15,000 to 100,000 BTU per hour on a minimum of gasoline, kerosene, or fuel oil.

From the same boards have come the famous Fluid Heat automatic engine preheaters that give instant starts even though vehicles or boats are faced with Arctic temperatures.

You can put this vast engineering experience to work for you. What type of heating unit do you need? Will one of Fluid Heat's standard units, or an adaptation of one, do the job? Or do your requirements demand the design and development of more specialized equipment? In either case, Anchor's experience is at your command . . . as close as your phone or your secretary's typewriter.

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DIVISION OF ANCHOR POST PRODUCTS, INC.
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AC9115 **ALLOY STEEL**

for

Gas Turbine Structures

N-A-X AC9115 ALLOY STEEL offers a means of reducing the use of critical alloy steels of the "stainless" type in gas turbine and similar applications. In specific cases it has replaced over half the amount of strategic material originally required, with no sacrifice of quality.

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N-A-X AC9115 ALLOY STEEL is available in bars as well as flat rolled products. Investigate the outstanding properties and characteristics of this steel and, through its use, conserve the critical material so necessary to our nation.

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N-A-X Alloy Division • Ecorse, Detroit 29, Michigan

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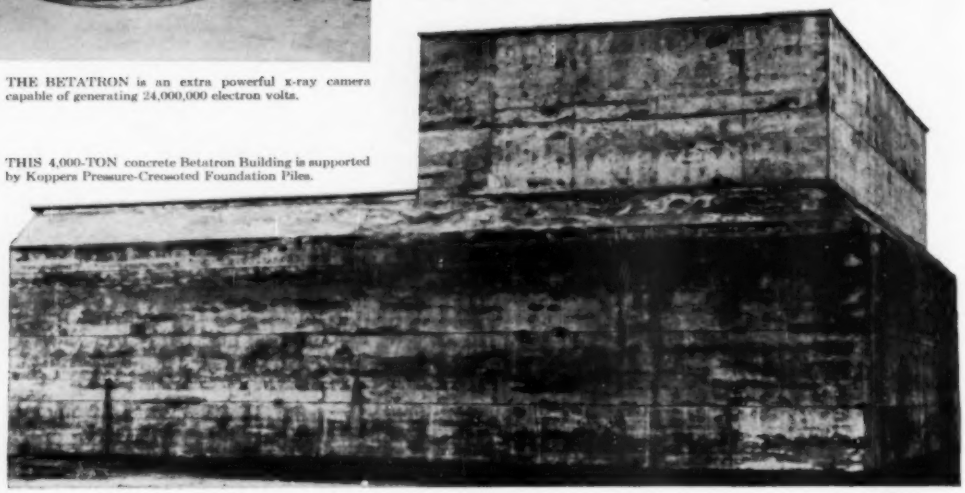
THE BETATRON is an extra powerful x-ray camera capable of generating 24,000,000 electron volts.

GIANT TANK X-RAY



THIS 4,000-TON concrete Betatron Building is supported by Koppers Pressure-Creosoted Foundation Piles.

founded on Koppers Pressure-Creosoted Piles

ONE of the two largest industrial Betatrons in the world is installed at the Eddystone Plant of General Steel Castings Company. It was built by the U. S. Army Corps of Engineers, Philadelphia District. This powerful Betatron produces x-rays that are used to detect flaws in steel castings for U. S. Army tanks. It operates at an extremely high 24,000,000 electron volts.

To protect personnel from this dangerous radiation, the building has solid concrete walls 6-feet thick. 1,500 yards of concrete were used; and the building weighs approximately *4,000 tons*. The foundation had to be strong and durable to support this load. And it also had to provide absolute stability for the delicate Betatron mechanism. To obtain this strength *and* stability—at low cost—Koppers Pressure-Creosoted Foundation Piles were used to support the Betatron Building.

Koppers Pressure-Creosoted Foundation Piles support industrial and commercial structures of practically every type. They provide lasting protection against fungi, termites, and acids or alkalies in the soil—and they cost less than other permanent pile material. Furthermore, they can be obtained quickly from Koppers wood treating plants.

If you would like more information on Koppers Pressure-Creosoted Foundation Piles, write to Koppers Company, Inc., Pittsburgh 19, Pa.

KOPPERS **PRESSURE-TREATED WOOD**

KOPPERS COMPANY, INC. **PITTSBURGH 19, PA.**

PLANNED during peace—

PRODUCED for defense!

Defense work at The Timken-Detroit Axle Company is in high gear—thanks to a thirty-year program of continuous research, development and production! Working in close cooperation with Armed Forces personnel since World War I, The Timken-Detroit Axle Company has never relaxed its efforts toward more efficient front and rear axles, brakes, transfer cases and running gear parts for military motor trucks.

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But the most important result of all is the fact that today The Timken-Detroit Axle Company is not discussing and planning defense work—*it's producing!*

TIMKEN Detroit AXLES

A PRODUCT OF THE TIMKEN-DETROIT AXLE COMPANY
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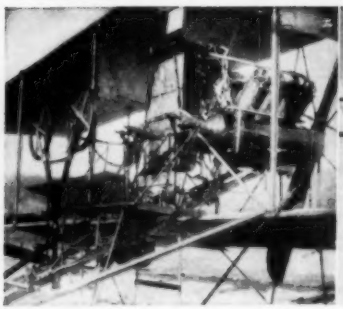
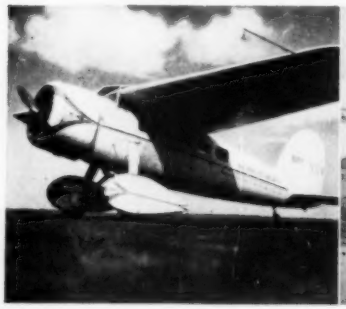
40 YEARS OF AUTOMATIC FLIGHT...BY SPERRY



1912 The first Sperry automatic pilot was flight tested in a Curtiss hydroaeroplane in 1912 at Hammondsport, New York. This was the world's first gyroscopic automatic pilot to fly an aeroplane.

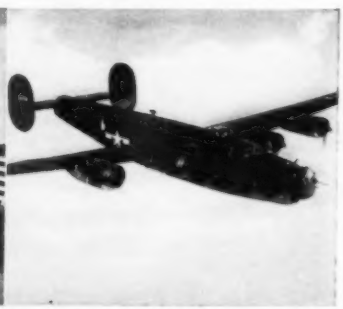
1914 Lawrence Sperry, in a public demonstration of automatic flight in Paris, 1914, won the International Safety Competition with his "stable" aeroplane.

1916 Ancestor of the guided missile was the aerial torpedo developed during 1916-18 by Sperry working with the U.S. Navy. These automatically controlled "flying bombs" were tested over Great South Bay, Long Island.



1933 Automatic flight again won public acclaim in 1933 when Wiley Post made the first solo flight around the world with the Sperry automatic pilot as his "co-pilot" in the WINNIE MAE.

1937 First completely automatic landings were made by the U.S. Army Air Corps in 1937 by coupling radio aids to the Sperry automatic pilot.



1943 The first electronic automatic pilots flew thousands of B-24s in World War II and advanced the art of precision bombing by providing an improved stable platform.

1947 The first "pushbutton" aircraft, U.S. Air Force's All-Weather Flying Division's C-54, equipped with Sperry automatic pilot and automatic approach control, crossed the Atlantic both ways in 1947 without human hands touching the controls—including take-offs and landings.

1952 The modern Gyropilot* flight control is the outgrowth of Sperry's 40 years of research, development and manufacture of automatic controls for aircraft. This versatile, all-weather pilot represents a high-performance technique for automatic control which is readily adaptable to all types of aircraft—airliners, executive craft, jets, helicopters, lighter-than-air ships and guided missiles. This technique pioneered by Sperry has led to a new fundamental concept of flight for the aircraft of tomorrow. Sperry Gyroscope Company Division of The Sperry Corporation, Great Neck, New York.

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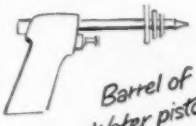
Bundyweld "Doodles"

to jog a designer's imagination

Frame of popular laundry hamper



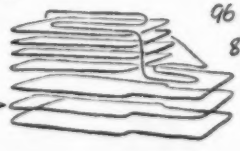
Barrel of Water pistol

Redesigning an old product? Developing a new one? With Bundyweld Tubing on the job, there's every chance for improved performance, lowered cost, smoother production, or some other practical plus.

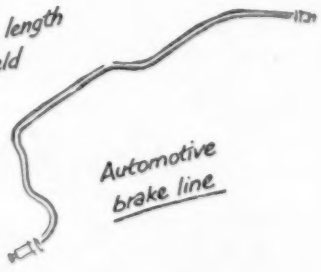
No other tubing has all the Bundyweld features. It's the only tubing double-walled from a single strip, with inside and outside beveled edges.

Too, you may profit from Bundy's famous fabrication skills. In working out tubing parts like those shown here, we may have found the answer to something baffling you. Or we can develop a new solution. Let us send you information on Bundyweld Tubing or Bundy services. ***Bundy Tubing Company, Detroit 14, Michigan.***

Coil for a Home Freezer



96 bends – 82' continuous length of Bundyweld



Automotive brake line

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

Extra-strong
High fatigue limit
Leakproof
High bursting point
High thermal conductivity
Shock-resistant
Ductile

Easily machined
Takes plating
Takes plastic coating
Scale-free
Clean inside and out
No inside bead
Uniform I.D., O.D.

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of copper-coated steel. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Copper coating fuses with steel. Presto . . .

Bundyweld, double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edges, which afford a smoother joint, absence of bead and less chance for any leakage.

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Anything You May Need in
TAPE-WOUND CORES

RANGE OF MATERIALS

Depending upon the specific properties required by the application, Arnold Tape-Wound Cores are available made of DELTAMAX . . . 4-79 MO-PERMALLOY . . . SUPERMALLOY . . . MUMETAL . . . 4750 ELECTRICAL METAL . . . or SILECTRON (grain-oriented silicon steel).

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Practically any size Tape-Wound Core can be supplied, from a fraction of a gram to several hundred pounds in weight. Toroidal cores are available in fifteen standard sizes with protective nylon cases. Special sizes of toroidal cores—and all cut cores, square or rectangular cores—are manufactured to meet your individual requirements.

RANGE OF TYPES

In each of the magnetic materials named, Arnold Tape-Wound Cores are produced in the following standard tape thicknesses: .012", .008", .004", .002", .001", .0005", or .00025", as required.

Applications

MAGNETIC AMPLIFIERS
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CURRENT TRANSFORMERS
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NON-LINEAR RETARD COILS
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THE ARNOLD ENGINEERING COMPANY

SUBSIDIARY OF ALLEGHENY LUDLUM STEEL CORPORATION
General Office & Plant: Marengo, Illinois

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You can depend on Delco Radio for on-time delivery of products with uniformly high quality.

LEADER...

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Delco Radio is the world's largest builder of automobile radios—the leader in production and assembly of component parts.

LEADER...

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Delco Radio developed many of the most important advances in automobile radios . . . has outstanding experience in this field.

LEADER...

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LEADER...

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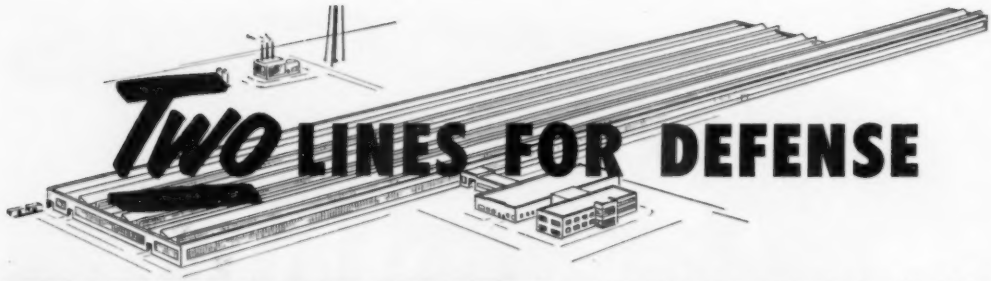
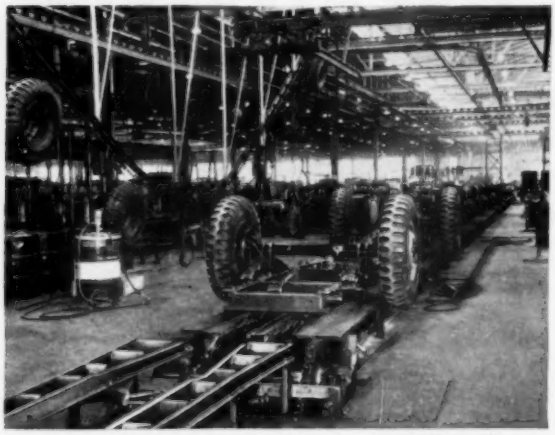
Completely integrated for efficient production from raw material to finished product, Delco Radio meets any customer need.

DELCO RADIO

DIVISION OF GENERAL MOTORS
KOKOMO, INDIANA



TWO LINES FOR DEFENSE



Military Trailers in Production at Avon Lake, Ohio.

Dry Freight Aerovans in Production at the Avon Lake Plant.

SIDE BY SIDE in Fruehauf's giant Avon Lake manufacturing plant, these two precision-production lines turn out a continuous quota of military and domestic Trailers vital to the defense needs of the nation. Special Military Trailers on the first line, and conventional highway-freight units on the second, both contribute directly to the efficient functioning of America's military supply system.

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Fruehauf's seven American manufacturing plants and their many hundreds of sub-contractors all share in this important job of supplying the nation with essential defense transportation. For Fruehauf Trailers serve not only in the regular delivery of necessary goods and materials to every American industry and community, but also as an indispensible part of the Armed Forces.

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FRUEHAUF Trailers

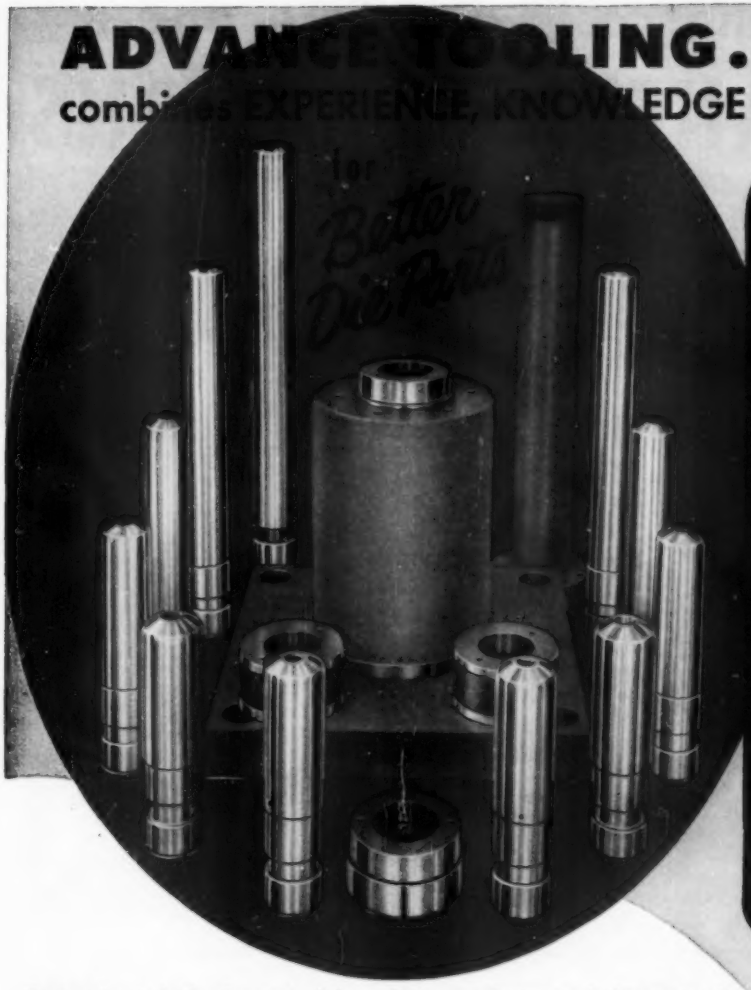
"ENGINEERED TRANSPORTATION"

AEROVANS | CHASSIS | POWDER HAUL VANS | STAKE AND RACK TRAILERS | CHEMICAL TRANSPORTS

TRUCK-TRAILERS FOR EVERY CIVIL AND DEFENSE NEED!

ADVANCE TOOLING...

combines EXPERIENCE, KNOWLEDGE and SKILL



Punches and Die Parts for 75 MM, 90MM & 105MM STEEL CARTRIDGE CASES

During the early development of the steel cartridge case in this country, Advance Die & Tool engineers were able to assist in the tooling for those parts. A wealth of experience and knowledge was gained about die materials, their physical characteristics, treatments and finishes required for proper surface conditions. Many thousands of punches and die parts were made at that time.

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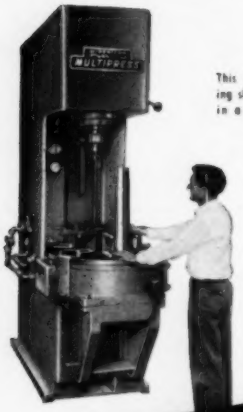
Cutting costs and time on
ORDNANCE OPERATIONS



This 35-ton Multipress is sizing shells to new specifications in a vital reclamation job.

MULTIPRESS®
answers more needs for faster, better production at much lower cost!

A 35-ton Multipress used in impressing identification markings on shell bodies.

Quick, easy conversion is an added Multipress feature . . .

In more ways than one, Multipress is the *quick* answer to a thousand-and-one production needs — on both ordnance and civilian jobs — where better results and lower costs are in top demand.

Multipress offers *quicker* deliveries! Eight basic Multipress frame sizes are expertly designed for easy, time-saving adaptation to a remarkable range of operations. Valving, ram controls, auxiliary feeds, operating accessories, automatic inspection devices, and special tooling can readily be interlocked in a single hydraulic circuit. Time delay, for ram dwell or similar needs, is also available.

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DENISON HydrOILics

THE INDUSTRY'S FINEST POWER BRAKING SYSTEMS

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Regardless of the size of vehicle or whether the preference is for vacuum or air, the trucking industry has come to look to Bendix Products as the one source uniquely qualified to meet every power braking need.

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Products of twenty-five years of practical braking experience, these outstanding power braking systems offer faster, more positive and better controlled braking. And in *both* the vacuum and the air actuated units, brakes can be applied instantly by foot power *alone*—a constant safety factor of tremendous importance.

That's why on highways everywhere the preference is for Bendix® Hydrovac® or Bendix Air-Pak, the Industry's Finest Power Braking Systems.

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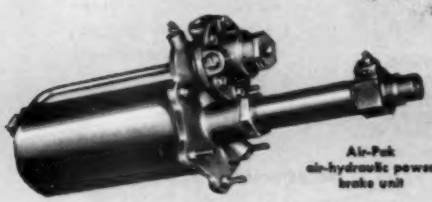
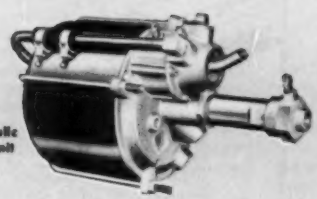


Air-Pak air-hydraulic power brake unit



Hydrovac vacuum-hydraulic power brake unit

BRAKING HEADQUARTERS for the AUTOMOTIVE INDUSTRY

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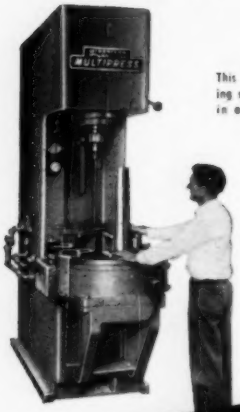
Export Sales: Bendix International Division, 72 Fifth Ave., New York 11, N.Y. • Canadian Sales: Bendix-Eclipse of Canada, Ltd., Windsor, Ontario, Canada

Bendix AVIATION CORPORATION

Cutting costs and time on

ORDNANCE OPERATIONS



This 35-ton Multipress is sizing shells to new specifications in a vital reclamation job.

MULTIPRESS®
answers more needs for faster, better production at much lower cost!

A 35-ton Multipress used in impressing identification markings on shell bodies.

Quick, easy conversion is an added Multipress feature . . .

In more ways than one, Multipress is the *quick* answer to a thousand-and-one production needs — on both ordnance and civilian jobs — where better results and lower costs are in top demand.

Multipress offers *quicker* deliveries! Eight basic Multipress frame sizes are expertly designed for easy, time-saving adaptation to a remarkable range of operations. Valving, ram controls, auxiliary feeds, operating accessories, automatic inspection devices, and special tooling can readily be interlocked in a single hydraulic circuit. Time delay, for ram dwell or similar needs, is also available.

Multipress is *quick* to prove its production advantages. The speed and accurary of its smooth, oil-hydraulic ram action offers *power-control* of full, stepless adjustability. The most exacting job requirements are met with dependable uniformity and safety. There's minimum chance for error, resulting in greatly reduced scrap loss!

These and other features are *quick* to cut production delays whenever you convert from one production job to another. Multipress capacities range from *one ton* to *fifty tons*! Find out how you can boost production *now* with Multipress equipment that can pay important dividends no matter what your future production needs may be. *Write today for full details.*

The DENISON Engineering Co., 1152 Dublin Rd., Columbus 16, Ohio

DENISON HydrOILics

THE INDUSTRY'S FINEST POWER BRAKING SYSTEMS

on Highways Everywhere!

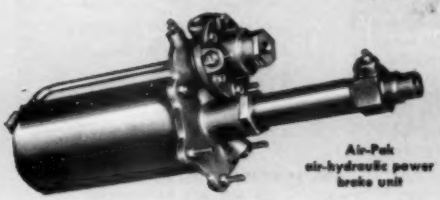
Regardless of the size of vehicle or whether the preference is for vaçuum or air, the trucking industry has come to look to Bendix Products as the one source uniquely qualified to meet every power braking need.

Hydrovac, the world's most widely used power brake, is the undisputed leader in the vacuum-hydraulic field. And Air-Pak is recognized as foremost in the field of air-hydraulic power braking units.

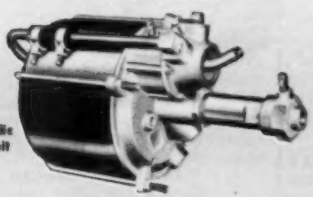
Products of twenty-five years of practical braking experience, these outstanding power braking systems offer faster, more positive and better controlled braking. And in *both* the vacuum and the air actuated units, brakes can be applied instantly by foot power *alone*—a constant safety factor of tremendous importance.

That's why on highways everywhere the preference is for Bendix* Hydrovac* or Bendix Air-Pak, the Industry's Finest Power Braking Systems.

*REG. U. S. PAT. OFF.



Air-Pak air-hydraulic power brake unit



Hydrovac vacuum-hydraulic power brake unit

BRAKING HEADQUARTERS for the AUTOMOTIVE INDUSTRY

BENDIX · PRODUCTS DIVISION · SOUTH BEND

Export Sales: Bendix International Division, 72 Fifth Ave., New York 11, N.Y. • Canadian Sales: Bendix-Eclipse of Canada, Ltd., Windsor, Ontario, Canada

Bendix AVIATION CORPORATION

JAN-P-116, Packaging and Packing for Overseas Shipment. Preservation, Methods of, May 8, 1945, and Amendment #2, Dec. 14, 1948, Method IIb "Container-Barrier-Container"

READ AND SAVE THIS ISSUE FOR FUTURE REFERENCE

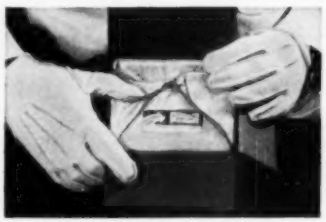
MILITARY PACKAGING SIMPLIFIED #3 of a series

The standard method of packaging and packing of electrical equipment and spare parts (electronic, electrical and electro-mechanical) shall be as described in JAN-P-658 and as amplified by joint Army-Navy specification JAN-P-116.

1. Small electric motor (not over 40#), properly cushioned, placed in a close-fitting carton with proper amount of desiccant. Note that desiccant should not be placed next to an untreated surface, as corrosion will occur. Carton should not be tightly taped; merely enough for physical strength.

2. Carton is immediately inserted in moderately snug-fitting bag constructed from MIL-B-131A, Class B material. Reynolds RM-103 if object weighs 10# to 40#; and RM-245 if object weighs 10# or less. Bag should be large enough to permit two additional heat seals at open end for inspection.

3. Bag is then heat-sealed immediately, first exhausting as much air as possible without stretching the material too tightly over corners of package. Care must be exercised in heat-sealing to be sure temperature, pressure and dwell time meet the recommendations of the barrier material manufacturer.



4. After barrier bag has been properly exhausted and sealed it should be identified as to contents. The protruding "ears" of the bag are then folded down and the entire unit is ready for insertion in the outer container which can be of fibre or wood. The bag should also carry a label reading "Method II Pack. Do not open."

5. The completed package ready for shipment. Note that the identification label and the Method II warning label are also required on the outer container. In many instances the outer container will be of wood construction; if so, it must be lined with kraft paper, or fibre board, to protect the barrier from puncture.

Method IIe—"Container Overwrap." This method uses the same materials (MIL-B-131A, Class B) as Method IIb pictured here, except the outer individual container is omitted and several units of barrier bags are overpacked in one wooden container.

REYNOLDS ALUMINUM LAMINATED BARRIERS ARE SUPERIOR FOR METHOD II PACKAGING

1. **Excellent moisture-vapor protection**
2. **Extremely rugged under all climatic conditions**
3. **Offers super-strength heat seal closure**

SEE REYNOLDS TRAVELING DEMONSTRATION OF MILITARY PACKAGING!

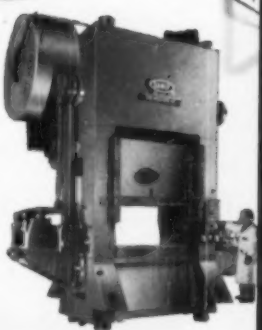
Government-specified methods of foil and laminated-foil packaging demonstrated with actual military products and parts. *Write for Coach Itinerary!* For expert help on any packaging problem, call the nearest Reynolds Sales Office and ask for the "Packaging Man." Or write direct to Reynolds Metals Company, General Sales Office, Louisville 1, Kentucky.

REYNOLDS ALUMINUM

Danly helps management solve today's production problems

Selecting the right press for the stamping job you are planning involves consideration of many important factors including cost, capacity, production rate and maintenance requirements. Danly simplifies this decision because Danly Presses are engineered for maximum efficiency in individual applications. Costly compromises between standard press models and your actual needs are eliminated.

Danly Autofeed Presses like the one shown at right have tripled production where faster cycling was required. Other Danly Presses are designed to meet practically every possible production need. Call a Danly press engineer today . . . let him help solve your particular stamping problem.



DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

Mechanical Presses . . . 50 to 3000 Tons

SINGLE ACTION STRAIGHT SIDE | AUTOFEED | UNDERDRIVE SINGLE, DOUBLE, TRIPLE ACTION | GAP FRAME | DOUBLE ACTION STRAIGHT SIDE

DANLY

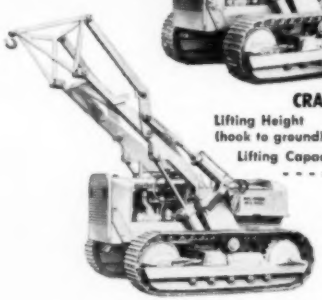
IT COSTS LESS TO RUN A DANLY PRESS!

MECHANIZE MATERIALS HANDLING

WITHOUT COSTLY INSTALLATIONS OR LOSS OF PRODUCTIVE TIME

use an Allis-Chalmers HD-5G and Tracto-Shovel Attachments

LIFT FORK ATTACHMENT
Stacking Height (under forks) - - 106 in.
Lifting Capacity - - - - - 4,000 lb.



CRANE HOOK
Lifting Height (hook to ground) - - 138 in.
Lifting Capacity - - - - 5,000 lb.

You speed materials handling "right now" when you put this fast-working tractor-shovel combination on the job. The HD-5G starts boosting production without waiting for costly installations or changes in plant layout. Digs into the toughest jobs, indoors or out . . . lifts, loads, excavates, pushes, tows... handles all materials, bulk, solid or packaged.

And it works easily in close quarters — turns in its tracks . . . has no bulky, overhead structure. Outdoors, the track-type tractor is not bothered by weather or ground conditions . . . works the year around, even in unpaved yards.

Choice of thirteen interchangeable Tracto-Shovel attachments makes the HD-5G a one-tractor material handling fleet. Special buckets, lift fork, crane hook, rock fork, 'dozer blades and others may be interchanged in a few minutes with simple tools.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Filling the Breach

at 250 Rounds Per Hour

W-S SEMI-AUTOMATIC SHELL BANDING PRESS

For Conventional Bands or Powdered Metals

Here's a machine that's setting new daily production records right at the shell banding station . . . with rates up to *250 per hour* on 90, 105, 120, and 155 MM ordnance.

With exception of the loading operation, control is entirely automatic. Pressing the "cycle-start" button causes twenty-four synchronized rams to move in radially upon the shell, exert preset pressure, and dwell for an automatically timed period. Another push-button operates the automatic air-ejector.

Where unit work pieces are large and heavy, this kind of mechanized operation and handling pays off in increased man-hour productivity even over extended work periods. The proven design provides the maximum in trouble-free availability and low maintenance . . . You get less rejects. Capacity 500 Tons . . . overall height 3 ft. . . . floor space required 8' 6" x 6' 0".

Write for complete details of this latest revolutionary development in our national preparedness machine.

WATSON-STILLMAN
ESTABLISHED 1848

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W-S Completeline

Branch Off.: 228 N. LaSalle, Chicago Ill. • Manufactured in Canada by Canadian-Vickers, Ltd., Montreal

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Bazooka shell assemblies get their protective finish with DeVilbiss Automatic Spray Equipment

Let us help you meet Government specifications in painting

A DeVilbiss Exhaust System provides safe, effective fume removal from these multiple solvent tanks.

We'll take this "bug" off your back. We are constantly working with Government painting specifications on jobs just like yours. Many firms have found our background and experience most helpful. You will, too!

Proper painting methods and equipment may enable you to get defense orders you might otherwise not get, or may possibly be the difference between profit or loss on some of your operations.

DeVilbiss equipment is used for everything, from the spraying of protective coatings on the smallest precision parts, shells, and bombs, to the finishing operations on locomotives, railroad cars, tanks, trucks, passenger cars.

Our experience is yours for the asking, without charge or obligation. Act now! Let us help you. Contact our nearest branch office or write the factory.

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FOR BETTER SERVICE, BUY
DEVILBISS

1st Choice for Defense Warning Systems!

CHRYSLER AIR RAID SIREN...

Sounds loudest warning ever produced!

Because of the tremendous power supplied by its Chrysler 180 horsepower Industrial V-8 Engine, this powerful siren produces 138 decibels of sound, 100 feet from the throat! It is the loudest warning sound ever achieved by modern production.

Costs less for complete coverage!

The Chrysler Siren offers greatest coverage with the least number of sirens. More sound carries over a wider area—a four-mile radius under normal conditions.

Independent Power!

All necessary power is produced by the V-8 Industrial Engine, making the Chrysler Siren independent of central power systems. For mobility, they may be mounted on trucks or boats, if desired.

Can Be Remote-Controlled!

By means of ingenious public utility circuits, Chrysler Sirens may be remote-controlled from a hidden control station. They can be manually operated at location site also.

Chrysler Siren Technicians will help chart your area. Just send us a geographical map, indicating the perimeter of coverage desired. Write Siren Layout Service, ***Chrysler Corporation, 12200 E. Jefferson Ave., Detroit 31, Michigan.***

Civil Defense is a common need, shared by all. Help yourself to preparedness. Join the Civil Defense group in your area.

CHRYSLER

AIR RAID SIREN

PRODUCT OF MARINE & INDUSTRIAL ENGINE DIVISION OF CHRYSLER CORPORATION

ROCKRITE TUBING

...the "heart" of the 3.5 rocket

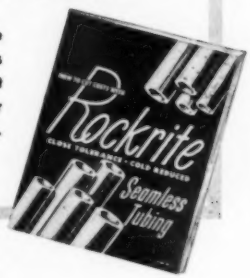
THE PROBLEM: How to speed production of motor bodies for the critically important 3.5 rocket. **SOLUTION:** The use of Rockrite Tubing made of high quality 4140 steel for "the heart" of the job.

Here's why. Rockrite Tubing is sized by a distinctively different process to *much closer tolerances* than are practicable by any other method. Thus, motor bodies need *less machining*, and vitally needed metal is saved. Scrap is 64 per cent less than with ordinary cold-drawn tubing. Uniform walls are obtained more easily. Also, Rockrite Tubing has a superior surface finish. To guard against ruptures in the rocket launcher, heat-treated Rockrite Tubing is subjected to and stands up against internal pressures of 25,000 psi in hydrostatic tests.

The 3.5 rocket is another example of how Rockrite Tubing can save time and machining costs in the production of vital ordnance parts.

16-PAGE BULLETIN

tells story of Rockrite Tubing, and contains many other important advantages. Write for your free copy today.



ROCKRITE® TUBING

TR-126

TUBE REDUCING CORPORATION · WALLINGTON, NEW JERSEY

FAST EARTHMOVING

AT SAVANNAH RIVER

Speed is the word on the great U. S. Atomic Energy Commission project in South Carolina. Twenty million cubic yards of earth have to be moved in a hurry. And modern machines are doing the job.

All over the vast Savannah River Plant area, experienced contractors are using "Caterpillar" equipment to keep production rolling on schedule. Stars of the show are the big two-wheel "Cat" DW21 Tractors, pulling No. 21 Scrapers. Push-loaded by D8 track-type Tractors, they carry 20-yard payloads and make the cycle in 2½ minutes on a 2,500-foot haul.

These units are built with the dependability typical of "Caterpillar" design. Fast, powerful, safe and easy to handle, they are breaking yardage records on long-haul, high-speed work. And teamed with "Caterpillar" four-wheel and track-type Tractors, Bulldozers, Motor Graders, Engines and Electric Sets, they round out the world's most complete line of matched earthmoving equipment.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

"Caterpillar" DW21 Tractors and No. 21 Scrapers, owned by R. B. Potashnick, Cape Girardeau, Mo., have averaged 1,500 cu. yds. per unit per day on a million-yard contract at the Savannah River Plant project.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

Where PRECISION GEARS assure a gentle lift!

The Bell HTL-4 and H-13D Helicopters are primarily used to bring battle wounded out, *and do it fast* . . . carrying them in their comfortable, warm, *safe* litters.

In Korea, the U.N. High Command says, the HTL-4 and H-13D saved 7500 lives in less than ten months!

We make the precise rotor transmissions for the HTL-4 and H-13D that assure a positive, smooth, *gentle* lift as the helicopter floats the wounded off the ground and soars swiftly to a base hospital.

Precision . . . in design and production. That is what we have been doing for 37 years. Now 90% of our defense work is on aircraft and ordnance contracts . . . for one part or a million . . . and *all* to the highest precision standards!

All this gives us inward satisfaction . . . satisfaction because through our products, we are aiding our fellow man, and helping to build our nation's defenses.

THE STEEL PRODUCTS ENGINEERING CO.

engineers and manufacturers
Springfield, Ohio

ENGINE PRE-HEATING

combined with personnel heating and defrosting in one heater!

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Floods engine components, battery, crankcase, carburetor with warm, heated air. Makes starting easier, faster—even at 65° below!

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Warm air—independent of engine heat, independent of engine operation—circulates swiftly, evenly, to keep personnel comfortable at all times.

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Keeps windshield reliably "frost-free." Assures clear vision, safer driving.

South Wind brings you all 3 in one heater!

• A new application—only in South Wind—brings you this amazing "all-in-one" heater! A small, compact unit...high in output ... meeting all the latest military specifications. Assuring efficient vehicle operation under the most stringent weather conditions.

Versatile! Applying with equal performance to trucks, stationery engines, air cooled and liquid cooled engines. **Powerful!** With an effective, useable output of 35,000 B.T.U.—remarkable in a unit so compact. **Adaptable!** Burns gasoline, jet fuel or kerosene. Simplified in operation. Easy to install.

Write Today for specific model information or experienced counsel on any phase of heating. Address inquiries to the South Wind Division, Stewart-Warner Corporation, Indianapolis 7, Indiana.

South Wind

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A PRODUCT OF SW STEWART-WARNER

PERSONNEL HEATING
ENGINE AND
EQUIPMENT PRE-HEATING
WINDSHIELD DEFROSTING

DEFENSE FINISHES *must fit* BOTH!

Producing finishes that fit government specifications for defense products is only half the job. Unless they fit the practical needs of finishing line operation, too, they can impose undue restrictions on output, efficiency, or both.

Sherwin-Williams experience, extending through both World Wars, together with technical service facilities extending from coast to coast, provides the broadest possible background for meeting *both* requirements in the production of specification finishes.

If you have a problem of adapting or devoting any portion of your production to defense contracts involving the use of finishes, your Sherwin-Williams Industrial Finishes Specialist can offer you valuable help. Call on him today, or write The Sherwin-Williams Co., General Industrial Division, Cleveland 1, Ohio. Industrial Zone Offices located in Philadelphia, Pa.; Newark, N. J.; Chicago, Ill.; Cleveland, Ohio; Grand Rapids, Mich.; Atlanta, Ga.; Dallas, Tex.; and Oakland, Calif.

SHERWIN-WILLIAMS
INDUSTRIAL FINISHES

for defense production . . . for civilian production

3 way help

on all finishing problems

1 Technical help on FINISHING METHODS

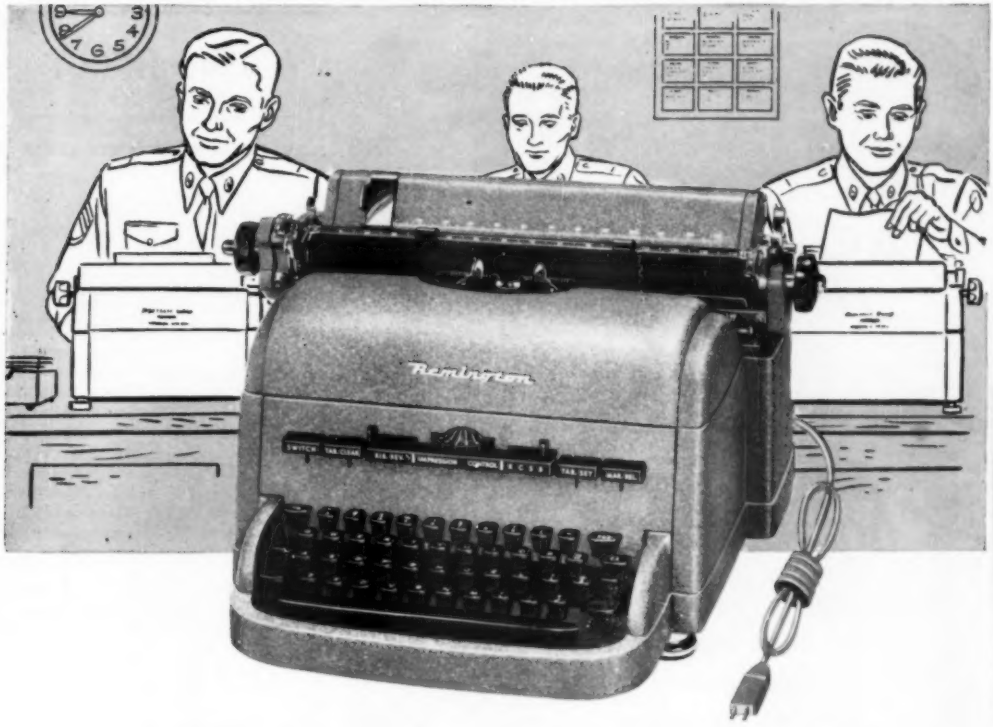
Do you spray, dip, flow-coat or all three? Sherwin-Williams' wide background of experience in all types of production finishing methods—including electrostatic, automatic and hot spray—may help you solve production problems, whether defense or civilian.

2 Specialized help on FINISHING MATERIALS

Sherwin-Williams Industrial Production Line Finishes include a complete line of primers, reducers and finish coats for air drying and baking, for wood and metal, especially designed to meet civilian production-line requirements.

3 Industry-wide experience on FINISHING DEVELOPMENTS

Sherwin-Williams' broad experience in finishes and finishing systems for all types of products provides every industry the benefit of improvements in materials and techniques developed in other specialized fields.



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Yes, along with vital civilian industries, our Armed Forces have discovered that Remington Electri-conomy Typewriters can turn out *more work, better work* in *less time* and *with less effort* . . . all with amazing electric ease of operation.

So why not turn to the Electri-conomy to meet your typing needs in these times when greater individual productivity and time schedules are so important.

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THE FIRST NAME IN TYPEWRITERS

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AC or DC made by PAGE for Armor Welding

the BEST for any weld . . . on all types of stainless steel

Retain Strength

• The great strength of stainless steel—used widely in all manufacturing including military work—is limited by the quality of welds which seal the joints. So you must choose electrodes with care to retain full strength.

Page offers you a full line of stainless steel armor welding electrodes, AC or DC, made to present Ordnance specifications. Arc is stable under all conditions. The metal flows smoothly. Slag is clean and easily removed. The coating resists cracking down to very short stubs. Available in 10-lb. lined, hermetically sealed, reclosable cans.

Be Sure . . . Specify PAGE STAINLESS STEEL ELECTRODES

ACCO

PAGE STEEL AND WIRE DIVISION
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Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE Welding Electrodes

ATOMIC ENERGY

NEW REACTOR ACTIVATED

A new nuclear reactor of advanced design has been put into operation by the Oak Ridge National Laboratory. The new reactor, known as the low-intensity test reactor (LITR) is being used to make high-priority tests of radiation effects on certain construction materials of possible use in future nuclear reactors. It will also produce limited quantities of rare radioisotopes such as chromium-51.

The LITR "went critical" early in the spring of 1950 as a nuclear mock-up of the materials-testing reactor (MTR) now in operation at the AEC's national reactor testing station, Arco, Idaho. It was then improved to operate at a higher power, and in the spring of 1951 was put into service for training MTR operators. Research facilities were added and the power further increased in the fall of 1951.

The LITR was designed and constructed by Oak Ridge National Laboratory, operated for the AEC by Carbide and Carbon Chemicals Company, a division of Union Carbide and Carbon Corporation. Its total cost was approximately $1,000,000.

The primary use of the LITR will be to assist engineers and scientists in learning more about how materials proposed for use in atomic furnaces of the future will stand up under the bombardment of neutrons—the nuclear particles that are the key to atomic fission. Since the LITR can produce both fast and slow neutrons at varying intensities, it is expected to be extremely useful in testing such materials.

The LITR at Oak Ridge was designed and constructed as one phase of the materials-testing reactor project. It began as a mechanical model of the working parts of the MTR in Idaho. When the model had proved the design and engineering aspects of the MTR, small amounts of nuclear fuels, control devices, shielding, and instruments were added.

The result was a low-thermal-energy model which could "go critical" and maintain a sustained chain reaction. It had become a reactor (early spring, 1950) and at this stage was used to test the nuclear characteristics and performance expected in the Idaho materials-testing reactor. The findings gave increased confidence in the ultimate safety and performance of the MTR.

Next, more nuclear fuel was added, thus increasing the density (numbers) of the neutrons produced in the model reactor, and more shielding was added. In

Staffed and Tooled for

HYDRAULIC ACTUATORS

TO A-N SPECIFICATIONS

Breeze has the engineering staff, the shop capacity and special test equipment to produce hydraulic actuators of all types.

All engineering work, from basic specifications to final design for production, can be handled for you.

High-capacity machine tools provide low unit costs.

Special tools, such as honing machines, give finishes to the exact micro-inches required.

Breeze has all the test facilities for magnetic inspection, proof and bursting pressure tests, life cycles and other A-N standards.

ANOTHER BREEZE MARK PRODUCT

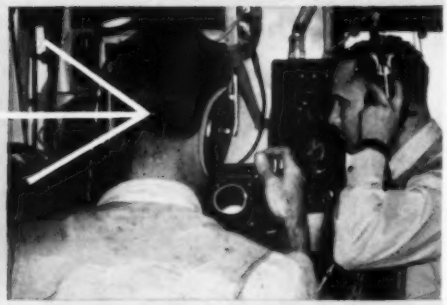
LONG EXPERIENCE by Breeze with all types of actuators — rotary or linear, electrical, mechanical and hydraulic — means that your actuators are engineered, produced, tested and delivered by a firm of specialists in the field.

If you have actuator problems that call for expert attention, call on Breeze for production.

BREEZE

HYDRAULIC ACTUATORS

BREEZE CORPORATIONS, INC., 41 S. Sixth St., Newark, N. J.



HUNTERS IN THE SKY!

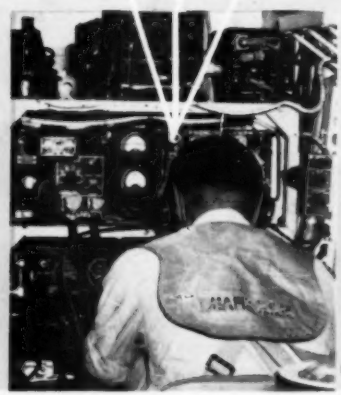
By remote control . . . seeking out and tracking the enemy target; pinpointing it unerringly for the kill . . . all through the modern marvel of electronic devices. Principal components of such devices are the magnetic units, elements of which are provided by Magnetic Metals Company in mass produced precision made magnetic core parts.

MAGNETIC METALS COMPANY

Soft Iron and Alloy Cores and Shields

21ST & HAYES AVENUE • CAMDEN 1, N.J.

MASS PRODUCED
PRECISION MADE



OFFICIAL U.S. NAVY PHOTO

this form, the Oak Ridge pilot model was used in the spring and summer of 1951 to train operators for work with its bigger counterpart, the materials-testing reactor.

Limited research facilities were then provided, giving Oak Ridge National Laboratory a complete and versatile new reactor model—one with exceptionally high neutron densities. The new facilities consisted primarily of added rooms and equipment on two sides of the temporary structure which houses the cylindrical tank enclosing the reactor core.

The reactor itself is about 2½ stories high. It uses ordinary water as a coolant and uranium enriched in U-235 as fuel. Because of its advanced design, the structure of its core and its fuel arrangement remain classified.

INDUSTRIAL DEVELOPMENT

The Atomic Energy Commission has established at its Washington headquarters a new Office of Industrial Development headed by Dr. William Lee Davidson, formerly director of physical research for the B. F. Goodrich Company, Akron, Ohio.

M. W. Boyer, AEC General Manager, said the purpose of the new office would be to aid in the administration of the industrial-participation program—involving studies of power generation—and to expand the areas in which all types of industry may find an interest in the national atomic-energy program.

"The Commission's program of industrial development," said Mr. Boyer, "will be a 2-way exchange. We want to make sure that the developments in the national atomic-energy program which may have application in industry are promptly made available to the people interested.

"Dr. Davidson's office will provide a point of contact with positive responsibility to foster wider industrial participation in the Commission's program and the development, as may be possible, of a more normal competitive approach to the problems and potentials of the atomic-energy business.

"The Commission's establishment of an industrial development office has important long-range implications looking to the day when industry will carry on its own a substantial part of the national atomic-energy program. Of immediate importance, however, is the support of the present defense effort which we expect to result from an intensive attempt to bring about a fuller utilization of both Government and industrial technological resources. This will require an expansion of the Commission's technical information services which have emphasized aids to scientific research for the acquisition of new knowledge rather than for its application in industry."

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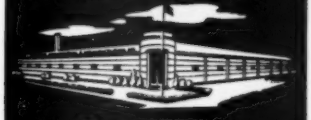

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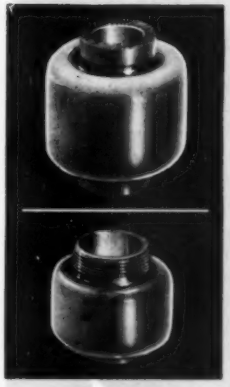

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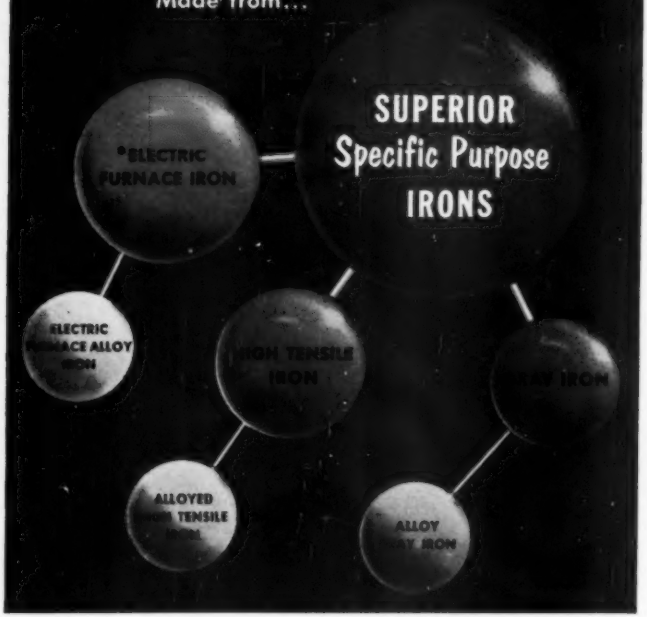

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Atomic Energy

ORE BONUSES

More than a quarter of a million dollars was paid out last year to uranium-ore producers under the new incentive-bonus program of the Atomic Energy Commission.

The graduated bonus arrangement (based on uranium-oxide content of the ore) was established in June 1951 in Domestic Uranium Program Circular 6 and was retroactive to March 1, 1951. It was one of several steps taken by the AEC to stimulate uranium production.

The payments have resulted in a sizable increase in the income of many small mining operators and have stepped up output of this raw material for the atomic-energy program. Approximately one-third of the seventy mines which have been certified for bonus payments had no production prior to March 1, 1951.

The bonus is offered to new producers and certain existing producers on that part of the first 10,000 pounds of uranium oxide in acceptable ore delivered to qualified mills or ore-buying stations between March 1, 1951, and February 28, 1954. The money is paid directly to the producers and is in addition to established prices paid by the various processing plants and purchasing stations.

NUCLEAR POWER STUDY

The AEC has begun negotiations with Dow Chemical Company and Detroit Edison Company on their proposal to continue for one year, on a jointly financed basis, the Dow-Detroit Edison study of greater industrial participation in the development of nuclear reactors for the production of fissionable materials and power. The work proposed by Dow-Detroit Edison is in line with the AEC reactor-development program.

The Dow-Detroit Edison group is one of the four pairs of industrial and power firms participating in preliminary studies as a part of the industrial participation plan first recommended by Dr. Charles A. Thomas of Monsanto Chemical Company. Other groups are Monsanto and Union Electric of St. Louis; Commonwealth Edison and Public Service of Northern Illinois, Chicago; and Pacific Gas and Electric and the Bechtel Corporation of San Francisco.

The two companies have estimated their cost of the extended studies at about $250,000. Work to be done by the Commission in this area of research, much of which is already under way or scheduled, may run as high as $750,000. The Commission's action does not constitute a selection among the four. Full consideration will be given to the other proposals as soon as the sponsoring companies submit reports for action by the Commission.

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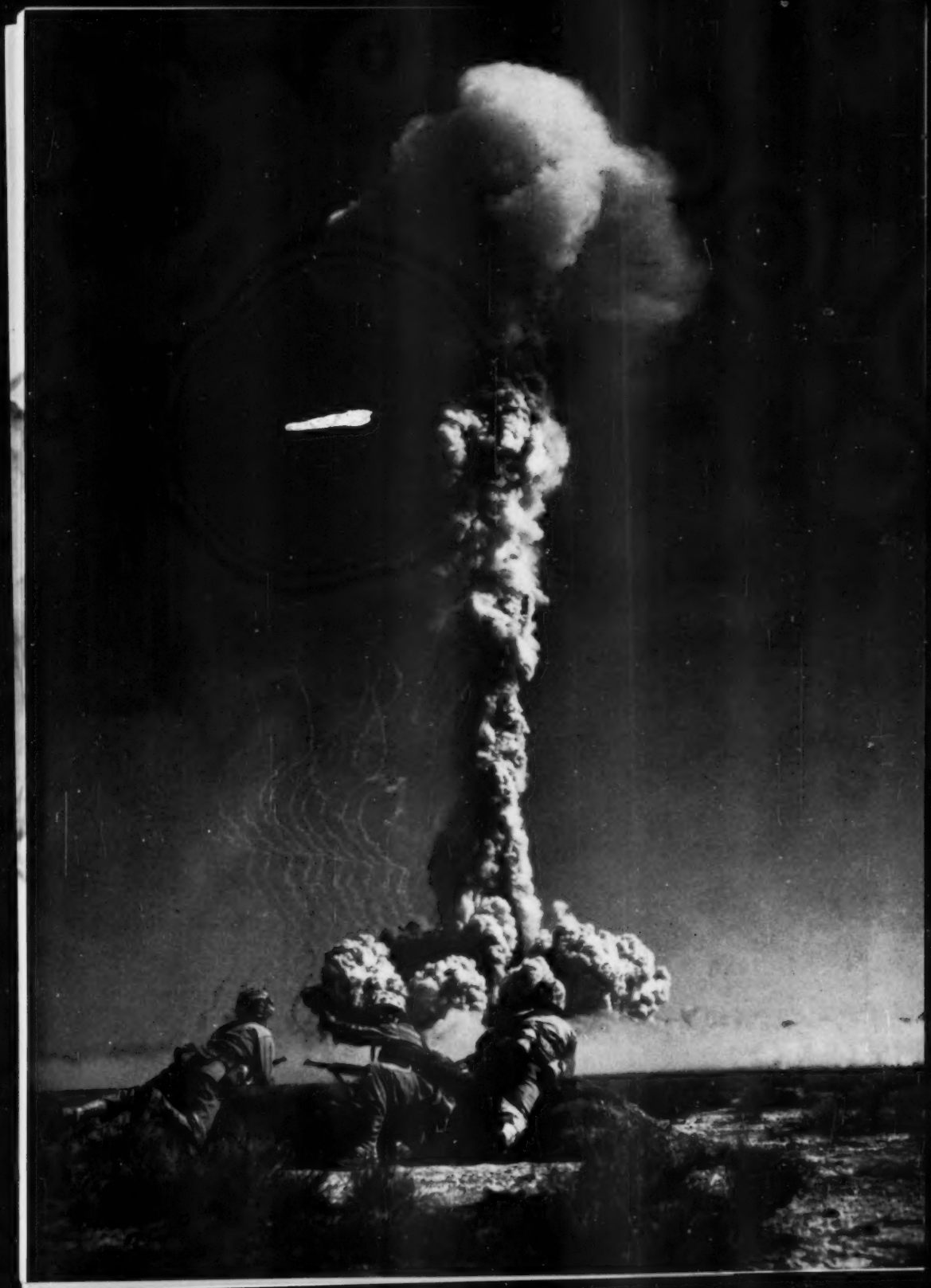


Research for Superior Weapons

The Ordnance Committee Helps To Achieve Better Matériel

THE basic objective of the Committee on Ordnance of the Research and Development Board is to coördinate, guide, and integrate the efforts of the military departments in seeking, through ordnance research and development, the best possible weapons and supporting systems for the armed forces of the United States.

Coördinates Program

Excluding atomic weapons and guided missiles, the Committee is coordinating a 250-million-dollar annual program, comprising approximately 2,000 research and development projects in the following seven fields: ammunition and explosives, fire control, fuzes, guns, ordnance materials, underwater ordnance, and vehicles.

The Ordnance Committee helps to bring the Nation's best scientific and technical talent to bear in solving military problems of a highly complicated and usually classified nature. Frequently, it utilizes the experience, resources, and personnel of the various Technical Committees of the American Ordnance Association and similar patriotic and scientific organizations. It is constantly seeking first-hand information on available manufacturing facilities and equipment, and it serves the valuable function of eliminating existing undesirable duplication in pioneering programs being administered by Army Ordnance, the Bureau of Ordnance of the Navy, and the Air Force Research and Development Command.

Fully informed of the latest advances in the fields of science and technology, and thoroughly acquainted with industry's competence to translate blueprints into weapons and equipment, the Ordnance Committee must also take into consideration the strategic global planning of the Joint Chiefs of Staff.

The Committee's program must at all times be geared to military realities. This means that the Joint Chiefs of Staff must pass judgment on the relative strategic importance of various major types of military operations and, as a direct consequence, on the technical problems related to these operations.

Whether research on antiaircraft weapons, for example, is more valuable at the moment than a similar amount of concentrated research on submarine-detection devices is a pivotal question that can be answered only by the Nation's top military, naval, and air leaders. Their decisions have the effect of charting the general course to be followed by the Ordnance Committee in its investigations.

But there is a further complication that has to be taken into consideration. The Ordnance Committee must keep the Joint Chiefs of Staff constantly informed of the probable development of new weapons and significant improvements that may be made in the performance of existing weapons, weapons systems, techniques, and countermeasures for probable enemy weapons systems.

Affects Global Strategy

This information may cause all sorts of changes and modifications in the global strategy formulated by the Joint Chiefs of Staff—and these strategic alterations undoubtedly affect the existing and future programs of the Ordnance Committee itself.

To maintain order, stability, confidence, and direction at one of the vital nerve centers of the Nation's defense effort is the heavy responsibility of Dr. G. P. Harnwell, Chairman of the Committee on Ordnance of the Research and Development Board. The Nation is fortunate that a physicist of outstanding scientific and administrative ability is occupying a position of such importance to the defense effort in these critical times.

Gaylord P. Harnwell, Chairman of the Committee on Ordnance of the Research and Development Board, whose photograph appears on the front cover of this issue, was completely unfamiliar with military technology prior to 1941.

Immediately following the organization of the National Defense Research Committee in that year, he was made a member of the Undersea Warfare Division. Dr. Harnwell spent the greater part of the war as director of the University of California's Division of War Research.

Upon the termination of hostilities, Dr. Harnwell retained his interest in technical undersea-warfare problems as a member of the Committee on Undersea Warfare of the National Research Council. He has been chairman of this committee since 1949.

At the Navy's request he served as chairman of a group in 1950 advising the Bureau of Ordnance on its torpedo research and development program and as director of a small group in 1951 to assist the Bureau of Ships in technical problems on mine countermeasures.

Dr. Harnwell has been professor of physics, chairman of the department, and director of the Randal Morgan Laboratory of Physics at the University of Pennsylvania since 1938. He became a member of the Research and Development Board's Committee on Ordnance in 1950 and has been serving as chairman of this committee since 1951.

←

THE BARRAGE—1952. *Atomic weapons will pave the way for the infantryman in modern combat as exemplified by these Marines about to charge an "objective" seconds after an atomic explosion at Yucca Flat, Nev. (Defense photo).*

The Defense of Europe —1952

The British Centurion Tank

The West Is No Longer Ripe for a Soviet Surprise Attack

George Fielding Eliot

THE past year of effort, culminating in the Lisbon conference of the North Atlantic Treaty Organization, has seen two notable steps forward toward European security:

1. Western Europe is no longer a sitting duck for a Soviet surprise attack.

2. The lack of centralized political direction for the great alliance—a lack which might well have been fatal in an emergency—has been met, at least partly, by the creation of a permanent Council headed by a permanent executive official, the Secretary General.

Two Accomplishments

These are outstanding accomplishments.

The dramatic debate over the participation of the Federal Republic of West Germany in European defense plans has tended to absorb a large measure of public interest, crowding the headlines so that these two solid gains have been lost sight of by the man in the street. They deserve much more careful attention.

Soviet Potential

Two years ago there was no question in the mind of any careful observer that the Soviet Army possessed the capability of overrunning Western Germany, the Low Countries, and France with the troops immediately available to it in Eastern Germany and Poland. This attack could have been delivered without warning since it required no extensive preparation or build-up.

One year ago the Soviet Army still possessed this capability, though in reduced measure. A delaying action along the Rhine was becoming possible, but not a prolonged defense.

No Surprise

Today the Soviet Army no longer possesses the capability of making an effective surprise attack westward from the line where the Iron Curtain bisects

Major Eliot is an internationally known author and journalist. He is military and naval correspondent for the *New York Herald Tribune*, military analyst for the Columbia Broadcasting System, and has written such books as "The Ramparts We Watch," "The Strength We Need," and "Hate, Hope, and High Explosives."

Germany. A substantial build-up of troops and supplies would be required before any Soviet offensive in that direction could become an attractive military operation. Therefore the possibility of surprise has disappeared.

Balance of Power

The reason for this shift in the balance of military power is the build-up in numbers and armament of the Allied defense forces.

Two years ago the total Allied strength ready for combat in Western Germany amounted to seven divisions: two American (counting the Constabulary as the equivalent of an armored division), two British, and three French. All were under strength. The French armament was largely obsolete, as were the British tanks. There were French, Belgian, and Dutch reserve formations which could have been called on in an emergency, but none of these had up-to-date arms and equipment, and in consequence none had much confidence in themselves.

The Soviet forces in Eastern Germany and Poland totaled thirty divisions. About half these were at full strength, but a scheme existed by which reservists to fill up the remaining half to full strength could be moved in almost overnight (this is still the case). This force included the equivalent of about twelve armored divisions.

Today, while the Soviet forces in East Germany and Poland remain at about the same level as two years ago, the Allied forces in West Germany or available for combat there have been nearly quadrupled in divisional strength and increased far beyond that in armament—and consequently in morale.

Allied Forces

There are now six American divisions (two armored), four British divisions (three armored—all equipped with the new Centurion tanks), five French divisions (one armored), three Belgian divisions (one armored), and the equivalent in "ready" forces of two Dutch divisions. In addition, five more French divisions (one armored) are in the eastern area of France, mobilizable in three or four days; and Canada, Denmark, and Norway each have a regimental combat team available, making the equivalent of another division.

The total is twenty-six divisions, well equipped with modern weapons and transportation, ready to fight and confident in their ability to fight successfully. These forces are under unified command, capable of operating as one army. This is not a force which thirty

"Today, while the Soviet forces in East Germany and Poland remain at about the same level as two years ago, the Allied forces in West Germany or available for combat there have been nearly quadrupled in divisional strength and increased beyond that in armament—and consequently in morale."

Soviet divisions can overrun in a hurry —or probably at all.

To hope for overwhelming and immediate success the Soviets would have to build up to fifty or sixty divisions, which is the maximum number they could supply in the early stages of an offensive in Western Germany. Even then they could not be sure they would not be stopped and held for a time at least.

Serious Change

This change is a very serious one from the Soviet point of view. Their planners have known for two years (ever since the North Atlantic Treaty was ratified) that an attack on Western Europe meant war with the United States and hence atomic retaliation against Russian cities and troops. But there was something to be said for the quick dash to the shores of the Channel and the North Sea, seizing French, Belgian, Dutch, and German territory within which we would be reluctant to bombard Soviet troops and whose inhabitants could be held as hostages against the atomizing of the Soviet Union itself.

Moreover, the very possibility of such a Soviet attack affected not only the morale of the Western armies but the confidence of their peoples—a fact reflected in hesitant national policies.

There is all the difference in the world in a situation in which such an attack can be delivered without warning, and one in which some at least of the tedious processes of mobilization and concentration have to be gone through beforehand, providing the Allies with time to consult, to make appropriate military dispositions, to call up reserves, and to decide on retaliatory measures. That is the situation in which the Kremlin now finds itself. It is far less cozy for them, far more assuring for us.

Italian Divisions

In miniature, the same condition now obtains on the northeast frontier of Italy. One great gain here, of course, is the shift of Yugoslavia from the Soviet to the anti-Soviet side. However, the Italian Army can now put into the field five infantry divisions, two Alpine brigades, and an armored brigade, and will add one more of each by midsummer.

This force is capable of making a strong initial resistance against sudden attack by the total Soviet forces now available in Austria and Hungary. Italy did not possess this capability a year ago. A factor in this estimate is the presence in Austria of about a division of Allied troops, plus American and British regimental combat teams in Trieste.

In Southeastern Europe the inclusion of Greece and Turkey in the North Atlantic Treaty Organization has brought their forces into the overall picture—and we find that here also the Soviets cannot hope to succeed with a surprise attack, but only with one carefully prepared and built up beforehand. The Greeks have ten divisions; the Turks have nineteen (of which three are cavalry divisions) plus six armored combat commands.

Soviet Capabilities

The Soviet forces in Rumania, plus the satellite armies of Rumania and Bulgaria, do not have the capability of launching an effective surprise attack against Greece and European Turkey; nor are the Soviet forces in Transcaucasia capable of overrunning northeastern Turkey by surprise or even of

breaking suddenly through the fortified mountain barrier. A factor in this situation is the doubling of U. S. naval strength in the Mediterranean.

Speed Slowed

All this is not, of course, to say that the Soviet Army cannot win a war on the continent of Europe, but only to say that it can no longer, as once it could, burst suddenly out from any of its frontiers and gain swift and overwhelming success.

What NATO has done in the past year is to bring its covering force up to reasonable equality with the immediately available Soviet striking force in these various theaters. The question of eventual military superiority becomes, therefore, a question of mobilizable reserves—which resolves itself into a matter of time.

To that question the Lisbon conference addressed itself in the announced quota for December 31, 1952, of fifty divisions in Western Europe (including Italy). This is a rise in a year's time of about twenty divisions—which will certainly not be first-line divisions of regular troops. They will be reserve divisions on the standard European model, composed of a cadre of regular instructors and specialists with successive classes of conscripts passing through year by year.

Trained Manpower

Right now there is no shortage of trained manpower in Europe. The shortage is one of modern weapons and equipment and the capacity to produce these things. Every year since 1945 the nations of Western Europe have been calling up their annual classes of conscripts and training them with what equipment they had. This process still goes on. To the extent to which modern arms are fed into the hopper, some of this trained manpower can be formed into fighting units.

As the conscripts complete their training (eighteen months or two years in most of these countries) they pass into the reserve where they remain available for first-line service for five or six years more, afterward passing to the second-line reserve. Therefore, when the Lisbon conference indicates that some twenty additional divisions, mostly reserve, will be available by the end of 1952, what that statement really means is that the shipments of U. S. weapons and equipment plus increasing European production of these items

is expected, by the end of 1952, to have provided the armament for these twenty additional divisions and that in the meanwhile sufficient equipment will be available to complete the training of the divisions with new weapons.

Thus, having first built a reasonably effective shield—the covering force of immediately ready troops—attention is now being turned to the reconstruction, behind that shield, of the normal military system of Western Europe, based on annual classes of conscripts trained by a cadre of professional officers and noncoms. As the "mobilizable" divisions increase in number and quality, the regular units can be reduced.

Conscripts and Supplies

This process, carried to its logical conclusion, will be completed when the conscript system is again working with full efficiency and the military production of Western Europe is again capable of supplying the full requirements of the armed forced of the various countries. That is why such great emphasis is now being laid on U. S. assistance to European arms output.

It is, of course, obvious that continued supply of U. S. weapons to European forces is highly uneconomical as well as full of inconveniences in such matters as the supply of spare parts. It is an expedient only, to fill a temporary need. Great opportunities for standardization are afforded as the shift of emphasis from U. S. to European armament sources takes place, and the advances made in this field are already notable.

All this draws the intangible bonds of the great Alliance more firmly together as well as improving its fighting ability.

"To hope for overwhelming and immediate success the Soviets would have to build up to fifty or sixty divisions, which is the maximum number they could supply in the early stages of an offensive in Western Germany. Even then they could not be sure they would not be stopped and held for a time at least."

Divisions Compared

Comparisons have sometimes been made by critics of the Military Assistance Program between the often-stated figures of Russian ground-force strength (175 divisions) and the proposed levels of strength in Western Europe. One might imagine that the Russians maintained 175 full-strength divisions at all times. Of course they don't—they must call up reserves to mobilize their forces, and that takes time.

What is hoped for is to establish a balance of power in which Western Europe will again be superior or at least equal in mobilizable force—both quantitywise and timewise—to the Russian potential. The steps taken toward that end seem logical and are working out according to a well-devised plan, which is clearly set forth in the report of Gen. Thomas T. Handy, (U.S. military representative for Military Assistance in Europe) for use in connection with the Congressional hearings on the Mutual Security Program for the fiscal year 1953.

Air Power

So far we have dealt exclusively with ground forces. Air power is also a factor, and a very important factor, in the military security of Western Europe. Soviet air power does not, however, at present greatly increase Soviet capabilities of surprise attack, which is the basis of the preceding analysis. The reasons are:

1. For the past three years the top Soviet priority in the air has been the air defense of the Soviet Union, which has resulted in high-level production of interceptor aircraft (notably the MIG-15).

2. In consequence, the Soviet supporting air units, which would have the mission of providing air support for their armies, still largely consist of propeller-driven planes. It is not be-

"There are many troubles and uncertainties as we consider the defense of Europe for the coming year, but the two great achievements remain, solid and reassuring: The enemy *has* lost his capability for overwhelming Western Europe by surprise, and NATO at last *does* have a permanent and centralized political authority."

lieved that the Soviet air force will have a jet fighter-bomber in production this year.

Air Superiority

Therefore, while there can be no doubt that the Soviets could produce numerical superiority in the air over Western Germany, the Allied air forces would have a very great qualitative superiority. There is here no occasion for smug complacency, however. The situation will change, and we can be sure that presently Soviet jet fighter-bombers will become available.

The solution of this problem is not altogether a matter of Allied aircraft production and air-crew training. It is also a matter of air bases which, like so many other NATO problems, demands a political solution before a military answer can be formulated.

As regards France, no better explanation of the situation is available than that written by a French schoolboy in the course of an English lesson:

"Airfields need flat ground. French farmers think flat ground is to grow cabbages on. French farmers can vote. This makes it hard to get new airfields in France."

Probably some of these difficulties will be overcome as the air-defense and supporting missions are gradually taken over by French and other European air forces. It is easier for a French government to deal firmly in such matters as expropriation of property when this is not being done for the benefit (as the farmer sees it) of foreigners.

Closer Integration

But this airfield situation does bring up the need for closer integration of political as well as military leadership in the North Atlantic Treaty Organization, and it is in this respect that the Lisbon conference made its second great advance.

It established a permanent Council, with members of ministerial rank, having a permanent headquarters in Paris and headed by a full-time executive officer with the title of Secretary-General.

Fortunately the services of a man of unique qualifications and experience were obtained for the latter post—General Lord Hastings Ismay, who has served previously as secretary of the British Committee of Imperial Defense, as military adviser to the War Cabinet, and all through the late war as Chief of Staff to Prime Minister Churchill in the latter's capacity as Minister of Defense. Probably no living human being has had as much practical experience with the twin problems of military-political relationships in a democratic state and of how to make military alliances between democratic nations work.

Permanence Important

But aside from Lord Ismay's outstanding gifts, the fact of permanence is of chief importance. Hitherto the NATO Council has come into being only at those intervals when it was convenient for foreign ministers, defense ministers, and finance ministers to lay aside their regular tasks and travel to a meeting place to hurry through a prepared agenda.

The Council of Deputies, supposed to fill the gaps between meetings, represented only the foreign offices of the various countries, and anyway the deputies had no power to decide—only to consult.

When the Council met it made what decisions it could, but there was no provision for readjustment to meet the unexpected—which always happens. Ministers returning home became immediately absorbed in the accumulated work piled up in their absence, so the system just didn't function.

Governments Represented

The members of the new permanent Council represent not just foreign offices, but governments. They can speak with authority. They have real power to take action. And they are on the job all the time. Moreover their work will be coördinated by the permanent Secretary-General—a sort of civilian Eisenhower in his relationship to the alliance as a whole. (Despite the fact that Ismay actually is a professional soldier of forty-one years' service, his job is a civilian one.)

The beneficial effect of this new leadership should be felt throughout the NATO structure. Of course everything isn't rosy yet. Far from it. The new divisions aren't one hundred per cent efficient according to SHAPE standards. But they can fight, and neither are the Russians one hundred per cent efficient.

Actual U.S. deliveries of "end items" (completed tanks, guns, planes, and so forth) are far behind schedule, and it is hard to establish firm delivery predictions.

The Mutual Defense Assistance Program is beginning its third year—and deliveries to Europe in February 1952 were already double those of December 1951, with further rises in prospect for March and April. Of course resumption of full-scale hostilities in Korea—or the outbreak of serious trouble elsewhere—could upset this prospect—which is one reason why our European allies aren't too enthusiastic about a tough attitude in Korea.

Hope and Courage

Thus there are many troubles and uncertainties as we consider the defense of Europe for the coming year, but the two great achievements remain, solid and reassuring: The enemy *has* lost his capability for overwhelming Western Europe by surprise, and NATO at last *does* have a permanent and centralized political authority. Considering the past history of military alliances, these accomplishments in so short a time may well give us hope and courage for the future.

Testing Naval Ordnance

Navy photo

Task of the Research and Development Center at Inyokern

Capt. W. V. R. Vieweg, U.S.N.

Commander, Naval Ordnance Test Station

IT is vitally important in modern warfare that we select and design with great care the weapons that will be produced in large quantities to bolster our defense arsenal. Not only must we build the right weapons, but what we build must meet the severe requirements imposed by the challenges presented today.

Conditions Uncertain

We cannot know when and where and under what conditions we must fight. Whether it may require weapons for use in the tropics or on the ice-caps, what we build and stock-pile must be fully effective. It would be suicidal to overextend ourselves producing the wrong things, expending manpower and materials and ending up with a stock pile of weapons that had questionable applicability to the military problems with which we must deal.

It follows then that research and development in the field of weapons play a vital part in our determination to assure that our energies, both industrial and military, are not dissipated.

The Naval Ordnance Test Station (NOTS), Inyokern, Calif., is one of the largest research and development centers in the United States. It exists in general to do research, development, testing, and fabrication of prototypes, and production of pilot lots in the fields of rockets, aviation fire control, and torpedoes. Testing in a limited area of the guided-missile field also is conducted.

The facilities, organization, staff, and methods of operation at the test station are founded in the philosophy that maximum efficiency in the research and development of weapons is materially enhanced when research, development, and testing are carried out in close propinquity and directed primarily by civilian scientific personnel of the highest quality, assisted by military personnel with operational experience and combat prospects.

The operation of a center to carry out this philosophy requires access to an industrial area for development processes, as well as a large uninhabited area for firing ranges. This combination of requisites led to the placing of the principal site of NOTS at China Lake, Calif., about 130 miles north of Pasadena.

Prior to April 1945, the facilities of the station were used primarily for the rocket program of the Naval Bureau of Ordnance, acting through the California Institute of Technology under its contracts with the Office of Scientific Research and Development.

Independent Activity

A significant departure—the beginning of the station as an integrated agency for weapons development—came about in the early part of 1945 when the Naval Ordnance Test Station was established as an independent activity to carry out the Bureau of Ordnance research and development program. That program and the test

station have been developed steadily since that time. Today the total replacement value at the NOTS plant has been estimated by the Bureau of Ordnance at $230,000,000.

In an area that once was Mojave Desert wasteland, 3,000 buildings have risen from the sand and sagebrush. Permanent structures of modern desert-type architecture are air-conditioned, and more than 400 miles of hard-surface roads wind through the station where once only desert trails and the burro tracks of prospectors could be found. The station has twenty-seven miles of railroad track.

Life Pleasanter

The sun still shines hot in the summertime, but life at NOTS for its 11,000 inhabitants is considerably more pleasant than it was in the first days of pioneering the station.

It is recalled that in late 1943, naval officers and scientists assigned to the station were faced with almost every imaginable problem of living. There were moon mirages and dust devils, side-moving lizards, jet-propelled tumbleweeds, and yowling coyotes out of the high Sierra Nevadas near by. Perhaps we still have many of these desert denizens with us today.

The commanding officer then shared his Quonset hut with the executive officer and the experimental officer. The hut was used not only as their living quarters but also as the administrative office of the base.

Many Facilities

Today the test station is a good deal different. Stores, a barbershop, beauty parlor, dispensary, chapel, theater, library, schools, athletic fields, gymnasium, swimming pools, and banking facilities are available. New housing developments for both civilian and military personnel are being constructed. At the present time 2,500 housing units are being occupied.

Nearly 5,600 civilians and about 1,000 military personnel man the station's offices, laboratories, and ranges. Navy exchange, commissary, and recreational facilities are exteneded to civilian personnel.

Twelve ranges for test firing missiles surround the community. Some of these ranges, with an array of equipment to evaluate the performance of test missiles, extend as far as thirty miles.

While the headquarters and principal site of NOTS are at China Lake, it has several additional activities scattered over the Mojave Desert, the greater Los Angeles area, and San Clemente Island off the California coast. The China Lake activity is about 150 miles north of Los Angeles where Kern, San Bernardino, and Inyo Counties have a common point. It has an area roughly 25 by 40 miles in size, with the Randsburg Wash activity to the southeast about 25 miles distant and measuring about 10 by 20 miles.

The Pasadena activities consist of the Foothill Plant, the Green Street offices, and the Thompson Laboratories. The Morris Dam activity is located in the San Gabriel Canyon to the eastward of Azusa.

Michelson Laboratory

The China Lake area contains the Michelson Laboratory, which houses the bulk of the NOTS technical organization. Named for Albert Abraham Michelson (1852-1931), the distinguished American physicist, the structure is made up of 16 concrete units and contains more than 9½ acres of floor space.

Designed to accommodate a staff of about 600, it is equipped for basic and applied research in physics, chemistry, aërophysics, metallurgy, and ballistics, and for development work on propulsion, fire-control, and guidance systems for rockets and other missiles. Its facilities include a technical library, materials testing laboratory, machine shop, heat-treating and electroplating shops, and a controlled-altitude test chamber capable of simulating desired conditions at various altitudes.

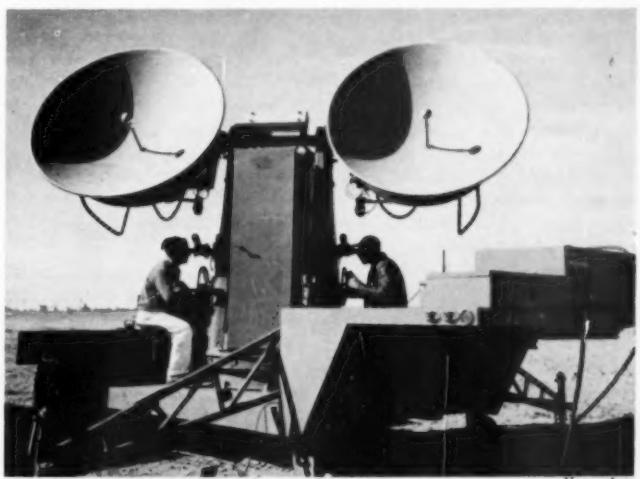
Range Areas

Also in this area are the propellant and high-explosives pilot plants, the aircraft ranges for the air firing of rockets and guns in development tests of missiles and fire-control systems, the ground ranges for ballistic test firing of rockets and missiles, together with various tracks for controlling the flight of missiles during ballistics tests.

In the China Lake area also is the Naval Air Facility at Armitage Field, which is an important supporting activity to this command's job of testing and evaluating ordnance equipment, including airborne fire-control gear.

The Randsburg Wash area southeast of China Lake is a test range for fuzed rockets and gun projectiles.

In Pasadena, the Foothill Plant and laboratory are the center for the pilot production of parts of rockets as well



Navy photo

Above, velocimeter is used to determine drag coefficients of a guided missile.

as for certain activities in the development of underwater ordnance. The Green Street offices provide space for design and administrative groups. The San Clemente activity, located on San Clemente Island, is used for water studies and ballistic experiments.

Variable-Angle Launcher

Morris Dam in San Gabriel Canyon is devoted to various problems associated with torpedo design. The variable-angle launcher located at Morris Dam is the only known facility of its type in the world. Designed to shoot missiles into water under exactly controlled conditions, the device consists of a 300-foot launching tube resting in a bridge structure. Designed by the Underwater Ordnance Division, the launcher carries an elaborate array of instruments, including high-speed motion-picture cameras to record the behavior of fired projectiles.

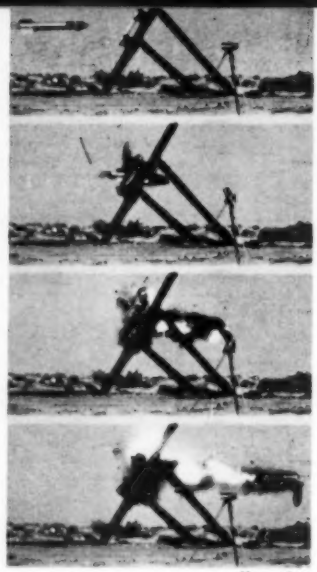
The Thompson Laboratories at Pasadena, recently acquired, provide the headquarters for underwater ordnance research and development and the administrative staff, as well as the administrative offices for the Pasadena activities of NOTS.

Our scientific and engineering program is carried on by an outstanding group of personnel, of whom 125 are doctors of philosophy, 225 have masters' degrees, and 750 have bachelors' degrees in some field of science or engineering. Of the nearly 1,000 military personnel, 140 are officers.

There are seven technical departments at NOTS, each normally headed by a civilian who reports to the technical director, who in turn is responsible to the commander. There also are seven supporting departments headed by naval personnel at the captain or commander level, with exception of the personnel department and community-affairs department which are headed by civilians of comparable grade.

Supporting Departments

Supporting departments report to the executive officer, who is responsible to the commander. There are also the Marine barracks and a command for administration of naval enlisted personnel.



Navy photo

Above, the new 11.75-inch "Tiny Tim" rocket penetrates a sheet of armor plate in Navy Ordnance test.

General considerations in the station organization are as follows: The mission of the station is to produce ideas for naval ordnance and to apply them with maximum efficiency to the needs of the Navy. To accomplish the desired results, adequate facilities and funds and superior professional personnel are mandatory.

Prime Responsibility

It is the responsibility of the professional civilian staff to produce technical accomplishments in research, development, design, test, and supporting activities. It is the primary responsibility of the professional officers to keep the civilian technical staff advised of fleet requirements and operating conditions and to collaborate with them in the conduct of evaluation and other technical work involving operational considerations.

The technical programs of NOTS may be summarized by indicating briefly the scope of activity of the various technical departments:

The Research Department conducts basic and applied research in chemistry, physics, mathematics, and ballistics, as they relate to the station's program.

The Test Department operates the ground ranges, including the development testing of guided missiles and rockets, the associated data assessment, and the improvement and extension of range instrumentation and facilities.

The Aviation Ordnance Department carries out applied research and development in the field of aircraft fire-control equipment. It also develops facilities and testing techniques for other aviation ordnance equipment. This department also operates the aircraft ranges.

Rocket Department

The Rocket Department carries out research and development on rockets and rocket propellants. This includes development and design of air-fired as well as ground-fired rockets with various fuzes and characteristics. This development work covers the complete rocket; *i.e.*, the head, motor body, propellant, fins, nozzles, and fuzes.

The Explosives Department conducts development work and pilot production in the field of high explosives.

The Underwater Ordnance Department is responsible for the development of underwater weapons. It also carries on applied research and development work in water entry, underwater ballistics, and propulsion systems.

The Design and Production Department is concerned primarily with product and production engineering, and bridges the gap between the development programs carried on here and the initiation of large-scale production conducted elsewhere.

Today the Naval Ordance Test Station is in the business of developing and testing weapons.

Weapons Research

As part of a national program, the Navy is conducting at this station a weapons research and development center whose program is fully coordinated with all the armed services. It is a part of our job in the national effort to contribute to clear technical perspectives; in other words, to help build, in proper balance, all components of national strength—not only weapons of war but broader scientific knowledge which can be a powerful weapon for peace.

Production for Peace and War

Dual-Purpose Plants May Be the Answer to Our Defense Needs

J. F. Wolfram

Vice-president of General Motors Corporation and general manager of Oldsmobile Division

THE production problem now facing the United States is tremendously complex. Actually, it is two problems in one: We have to provide the arms necessary to build invincible American military defenses and, at the same time, we have to keep our national economy healthy and strong, with adequately balanced civilian production.

Important Matter

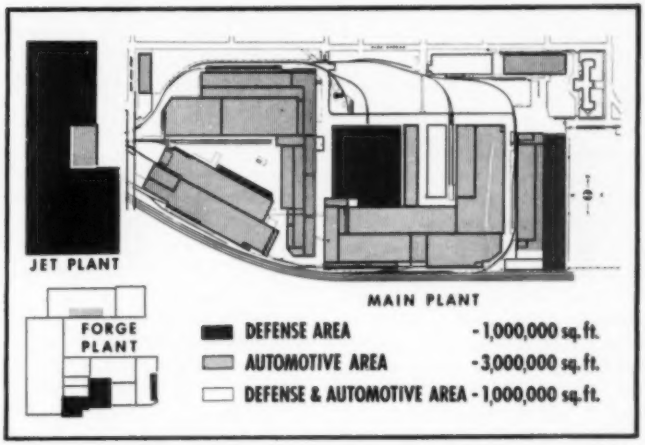
Our handling of this double-barreled production job is a matter of vital importance to every one. In my opinion, it is not too much to say that the democratic peoples of all the world are relying upon American productive power to defeat the evil schemes and aggressions of their Communist enemies.

I know that it is going to take more than weapons and materials to defeat the Communist enemy. I know that a nation's defenses are built not on steel alone—but also on the spirit and character of its people. This is especially true in the struggle against Communism. The qualities which make up the character of a free people—courage, respect for the individual man, love of democracy, faith in God—all these are essential weapons in the fight.

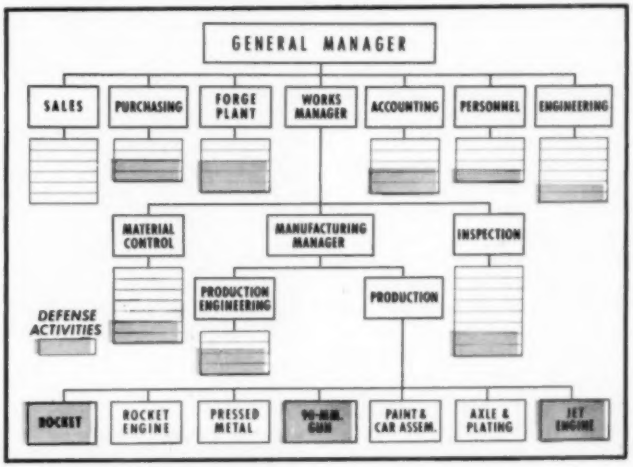
Complete Confidence

However, I certainly am not worried about our national spirit. I have complete confidence in the character of the American people—the strong character that built this great democracy.

There can be no question that we have the will and determination to stand and fight for our democratic heritage. Yet we must face the fact that today, as never before, the key to victory is material production. And it is here that we find our problem.


JET PLANT
MAIN PLANT
FORGE PLANT
DEFENSE AREA - 1,000,000 sq. ft.
AUTOMOTIVE AREA - 3,000,000 sq. ft.
DEFENSE & AUTOMOTIVE AREA - 1,000,000 sq. ft.

The diagram above shows a dual-purpose Oldsmobile plant with the areas allotted to defense, automotive, and combined operations. The chart below shows the organization of such a plant when engaged in defense and automotive production.



In this technological age, wars are won by the best producers. Other things being equal, the nation with the strongest, most efficient industry will be victorious. And that is the case whether it be a cold war, a hot war, or something in between. That's the main reason why the United States stands today as the free world's bulwark against the Communist dictatorship.

America's productive power alone stands between the Kremlin and world conquest.

Plan Needed

As an American, I am very proud of that fact. As an industrialist, I am deeply concerned with the need for making the most of our great productive potential in this time of emergency. Like many other men engaged in the job of producing for America, and for democracy, I feel the need for a master production plan that would prevent the loss of time, money, and manpower which has hampered us in past crises and which is slowing our efforts to meet the present emergency.

Twice before, in two great world wars, we have faced such production crises. In each case, victory came, not through superplanning for the most strategic uses of America's industrial resources but rather through the sheer overwhelming vitality and size of our industrial structure and through the technical know-how of the men who operate American industry.

You'd think we would have learned our lesson. But we didn't. So here we are again, scrambling madly—at great cost in time, materials, man-hours, and money—to get our industrial power channeled into the production of military equipment fast enough to meet the crisis.

I know that many of you, taking part in our effort to organize for defense, have said to yourselves that there must be a better way. Well, there is a better way of producing for war and for peace.

A Better Way

In my opinion, a better way was outlined by Charles E. Wilson, president of General Motors Corporation, at a meeting of the American Ordnance Association in Cincinnati last October. In his address, which was published in the January-February 1952 issue of ORDNANCE, Mr. Wilson pointed out that we not only must consider the difficulties of arming ourselves against the immediate Communist threat but, he said, "world events have forced us to realize that for an indefinite number of years preparedness must be a continuing policy for Americans." He emphasized that this unprecedented struggle between the free democracies and the Communist dictatorship may go on for many years.

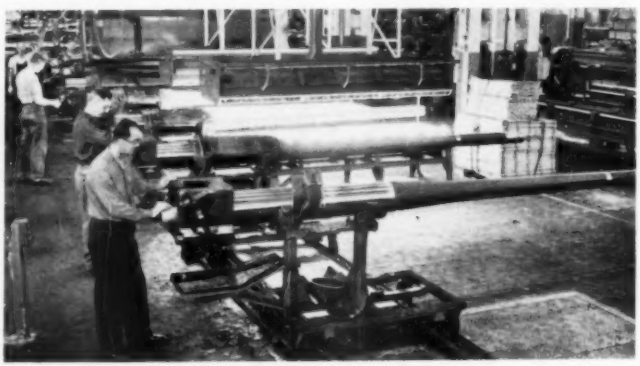
How?

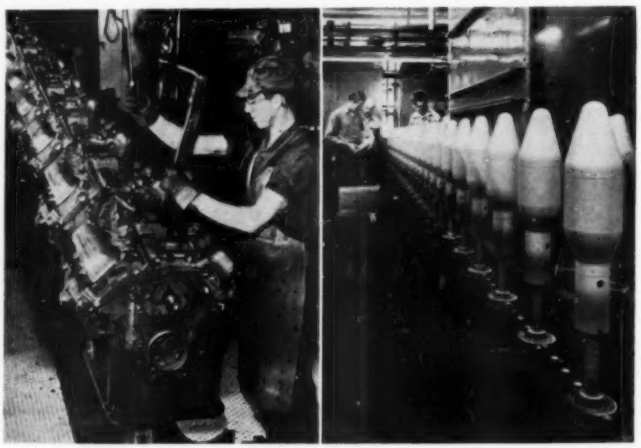
I'm sure we'll all agree that the Nation must make preparedness a part of its regular, organized course of business. The question is, "How?" How do we set up our defenses for such a long haul? How do we prepare ourselves to fight a powerful, dangerous enemy, while at the same time we maintain a strong, healthy civilian economy and preserve the freedoms and initiative of our democratic way of life?

Mr. Wilson answered those questions in presenting a plan of industrial operation which would sustain the Nation indefinitely in a program of producing for war and peace. Mr. Wilson's plan calls for a system of dual-purpose manufacturing plants. In some cases, these would be new plants. But the great majority would be existing plants, most of which can be adapted to dual-purpose operations merely through revising plant layouts to comprehend the dual-purpose plan.

Dual-Purpose Plants

As a matter of fact, foundries, forge shops, and most suppliers' plants are inherently dual-purpose in their layouts. They already have the flexibility needed to produce for war and peace simultaneously. It is only necessary to





Above, 90-mm. tank cannon are being produced on an assembly-line basis in an Oldsmobile plant while automobiles are assembled on an adjacent line. Below, auto engines and 3.5-inch bazooka rockets are made under "combined operations."

put them to work under the dual-purpose plan.

This dual-purpose plan is based on the essential American precept of efficiency in industry. It is simply the wise application of efficient production for peace and war.

The problem we face is obvious. We have to be able to produce for war and peace at the same time, over a very long period. And we have to do it efficiently, without wasteful expenditure of time and money. Otherwise we greatly endanger the national economy. And never forget that the enemy we face today will take advantage of economic weaknesses as quickly and effectively as he will exploit military shortcomings.

In order to meet the production demands of these critical times, we must have great flexibility in our industrial system. And that's what the dual-purpose plant provides—flexibility.

At Oldsmobile, when Mr. Wilson's plan first came to our attention, we already had taken a long step in the direction of the dual-purpose system with a setup we called "Combined Operations." Oldsmobile has been making bazooka rockets and tank cannon in volume without disturbing its car-producing facilities. During the coming year we will add compressors and turbines for jet aircraft engines. Here, again, it is not necessary to upset our car-producing facilities.

Easy Switchover

This comparatively easy switchover is the result of the planning and preparation inherent in our "combined operations" setup. However, "combined operations" goes only part of the way toward the dual-purpose system. This system comprehends industrial preparedness as a continuing policy. It catalogs each plant as a manufacturer of specific war material, such as cannon, jet engines, shells, etc. It provides that these plants are to have continuing contracts in keeping with the magnitude of the defense schedule and in relation to any cutbacks in civilian production. Also, it calls for the establishment of permanent defense areas in each plant.

These permanent defense areas, when in minimum use, would provide space to store the machine tools needed in defense work and would maintain a pilot line of defense production. The advantage of such permanent defense areas is obvious for many manufacturers probably have had difficulty in locating special machine tools for defense work because they were lost, or even liquidated, after the last war. The replacement of these tools is not only putting the nation to much extra expense, but it is causing a dangerous delay in the defense program.

"We have to be able to produce for war and peace at the same time, over a very long period. And we have to do it efficiently, without wasteful expenditure of time and money. Otherwise we greatly endanger the national economy."

Machinery Found

For example, when Oldsmobile obtained its contract for producing 90-mm. tank cannon, we were able to find in Government warehouses most of the special machinery required to produce the 15-foot gun tubes. In a warehouse in Houston, Tex., we located boring lathes, turning lathes, honing machines, and rifling machines which were promptly sent to our plant.

However it was impossible to produce a gun tube without cylindrical grinders to finish the recoil surface, and these machines could not be located any place in the United States. New grinders were ordered, but delivery could not be obtained for eight months. Therefore, the immediate availability of most of the machines was of no advantage because of the lack of grinders, which had not been saved after the last war.

You can see how much faster and less costly the defense job could be done if the machine tools for each defense item were retained on the premises of a dual-purpose plant.

It is also easy to see how important the permanent arrangement would be in the operation of a pilot line of defense production, even during full peacetime operations. These pilot lines would insure a steady improvement in the quality of our weapons and would provide a nucleus of efficient war production which could be swiftly expanded in times of emergency.

Single-Purpose Areas

The dual-purpose plant would also include the establishment of permanent peacetime production areas. For instance, in an automobile plant such as Oldsmobile there are certain production facilities that are not adaptable to armament production. An automotive assembly line, for example, is really single-purpose in its equipment and layout.

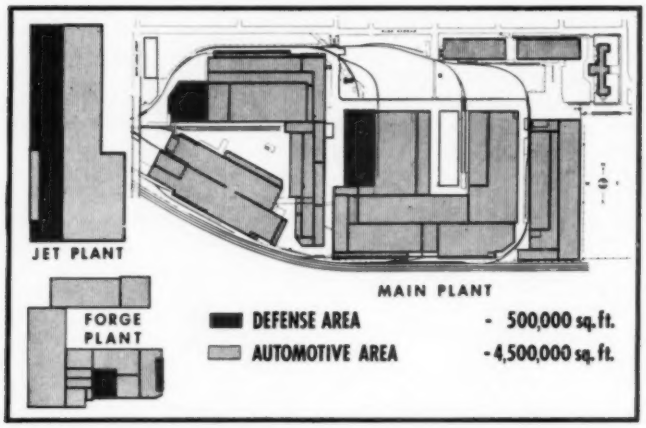
The same is true of a plating plant for bumpers, and of certain other plant sections. Such areas, then, in a dual-purpose plant would be assigned permanently to automotive production, whether in use or not. They would permit rapid, smooth reconversion to peacetime production after an emergency period.

Plan Adopted

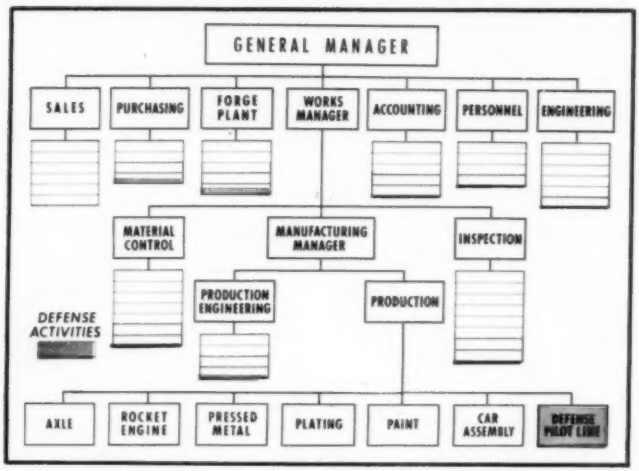
Needless to say, management at Oldsmobile, having already established our "combined operations," was tremendously interested in Mr. Wilson's idea for a system of dual-purpose plants. Now, after studying Mr. Wilson's proposal, we have laid out our plants, both old and new, in accordance with the dual-purpose plan.

The Oldsmobile main plant in Lansing, Mich., is situated on 157 acres and normally employs 11,300 workers. At present, because of the curtailment of automotive production by the Government and the fact that defense orders and tooling delivery have lagged, we now have 10,000 people working in this plant. This reduction has been accomplished without a layoff. We have merely not replaced those who have quit our employ or joined the armed forces. However, any further cuts in automotive production or defense production would entail a layoff of seniority employees.

We have planned our plant layouts comprehending three situations: first,



The above diagram shows a dual-purpose plant under all-out automotive production, the red areas indicating defense sections in stand-by while the colored sections below show the small portions of the organization retained for defense purposes.



all-out automotive; secondly, our present "combined operations"; and thirdly, all-out defense.

Public Demand Met

For all-out automotive production, Oldsmobile would be able to produce cars at a rate in keeping with public demand. Certain other areas would be permanent defense areas in which the equipment and machine tools for producing guns, rockets, and jet-engine parts would be stored and in which pilot-line operation would be maintained even during peace. Of Oldsmobile's 5 million square feet of floor area, it would be necessary to allocate permanently to defense work only about 10 per cent of this total, or 500,000 square feet.

In Oldsmobile's present situation of "combined operations" we are producing bazooka rockets and 90-mm. tank cannon. In the jet-engine and forge plants, we will be producing compressors and turbines for jet aircraft engines. In the area being used for automotive production we still have capacity to produce many more cars than the number we are permitted currently under Federal regulation. Some space is used for both automotive and defense work and is occupied by departments such as engineering, administration, planning, forge, toolroom, and die room.

Areas Allocated

About one million square feet of floor area is now allocated to defense work. Another million square feet is being used for both defense and automotive work, and three million square feet of area is still used for automotive work alone.

Under all-out defense conditions, three million square feet of floor area would be devoted exclusively to defense work, and two million square feet of floor area would be retained for automotive equipment. Most of this equipment is very specialized and not usable for producing defense parts. Plants like the "Rocket" engine plant, which are comprised of large complicated transfer-type machines, would be left intact so that a future swing back to automotive production could be made without extensive delays and unemployment.

Organizations Integrated

A good plant layout is fine, but we all know it takes people to supervise and operate the plants. Oldsmobile's approach to dual-purpose personnel organization has been to integrate fully this defense organization with the peacetime organization, at least as far as upper supervision is concerned.

In the case of manufacturing, the split-up occurs at superintendent level, but all staff operations are dual-purpose. We have chosen this method because we have found it to be more flexible as the volume swings back and forth from peacetime to war work.

It is interesting to note that even on an all-out peace basis, we recognize the necessity for a pilot-line operation on certain defense items so that improvements in the know-how and methods of manufacture of these war items can be developed even through the peace years.

Flexibility Attained

In the present era of "combined operations," flexibility is attained because of the fully integrated organization at the upper levels of supervision. Again, such an organization reduces

the necessity for dislocation of top supervision as we swing from one kind of production to another. Oldsmobile at present is actually operating a dual-purpose plant. I think that you can visualize the way in which this dual-purpose system brings about minimum loss of time and employment and minimum cost of swinging from one type of production to another.

Permanent Program

In his talk, Mr. Wilson suggested that it is time for the Nation and its government to decide that we need a permanent national-defense program; that the manufacturing industry is one of the major elements of that program and must be kept prepared at all times to produce the newest types of military equipment in whatever quantities are necessary.

Government Support

But to establish a system such as Mr. Wilson describes, it is not enough for individual plants to institute dual-purpose operations, even though that is a tremendous step in the right direction. We must have another element to make the plan really succeed—we must have Government coöperation and support.

As I see it, several important steps must be taken in order to establish a true, continuing dual-purpose system.

Specific Products

1. The Defense Department and the various branches of military procurement must recognize each plant as a facility for producing specific war products on a long-time basis. Oldsmobile, for example, would be recognized as a maker of tank cannon, bazooka rockets, and jet-engine parts. Continuing contracts would be given to utilize the plant's full capacity for producing those items as they were needed.

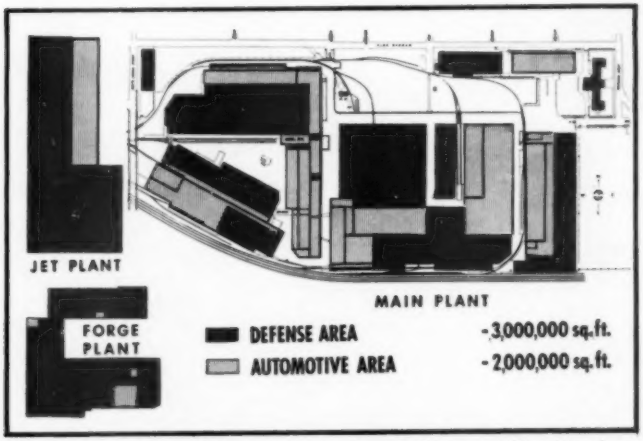
2. Government contracts must be made to provide for the most efficient storage of machine tools and other equipment used in war production. In each case the tools and equipment would be stored on the premises of the plant which would use them when needed.

3. Government contracts must be made to provide for the maintenance of a pilot line of war production. This pilot line would serve as the core of quickly expanded defense work in emergency. It would also enable us to improve our war product constantly and our methods of producing it.

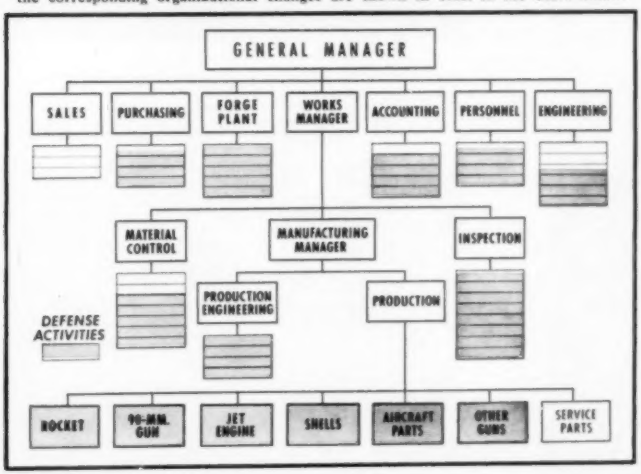
The Best Way

In my opinion, the dual-purpose plan is not only the best way of getting ready for war. It is the best idea yet advanced for preventing an all-out war. With such a plan in operation—putting the full force of American industry to work on a basis of continued preparedness—not even the most fanatical enemy could challenge us with any hope of success.

The dual-purpose plan comprehends a national realization that we can preserve our freedoms and our way of life only through constant vigilance, constant military preparedness against a cunning and powerful enemy. If we agree that preparedness must be a continuing policy for Americans, the dual-purpose plan would provide an industrial organization as a means of carrying out this policy through the various phases in the defense program, from all-out civilian production, through "combined operations," to all-out defense.

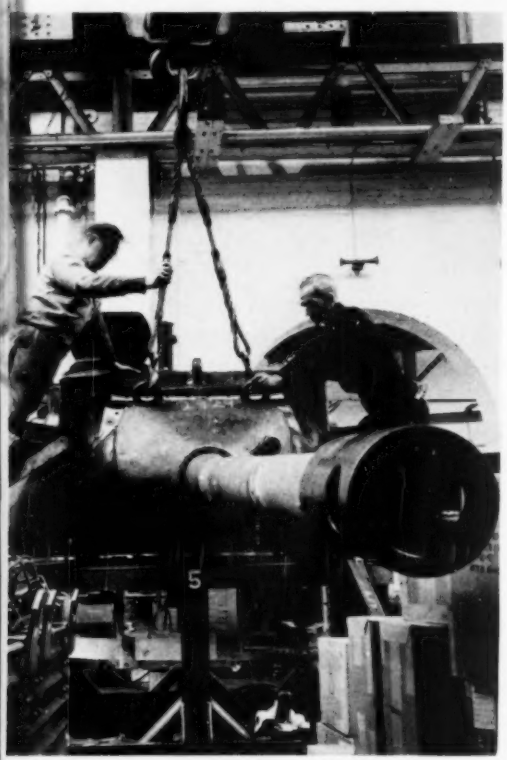


The areas devoted to defense production in a dual-purpose Oldsmobile plant under all-out emergency conditions are shown in red in the diagram above, and the corresponding organizational changes are shown in color in the chart below.

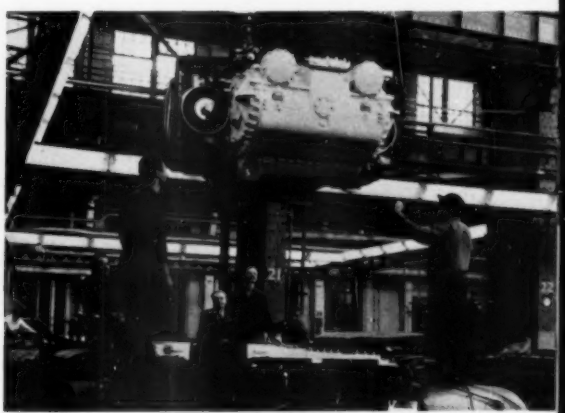


Our M47 Medium Tank—the Army's

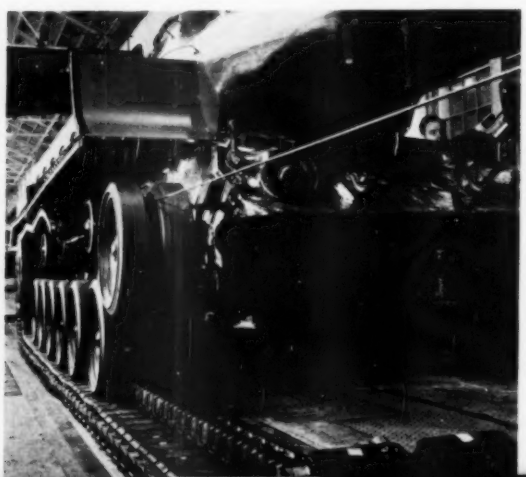
Above, technicians at American Locomotive Company's Schenectady plant check balance of turret gun in the new M47 medium tank. Below, workers prepare to lift turret and gun assembly into position on tank body.



Now in production, the M47 medium tank is neither a completely new nor a mere revised model of previous medium tanks. Instead, the turret from the experimental T42 tank has been mounted on an improved Patton hull, making an interim model that is hard to match. The new M47 can turn in its own length, traverse manually or by power, and has an automatic compensator to restore the aim of the 90-mm. gun after each shot.



Workmen, above, lower the air-cooled engine and cross-drive transmission (shown in white) into hull of a new M47 tank. Below, a winch and cable arrangement to install the new medium tank's 50-foot tracks cuts the time usually required.

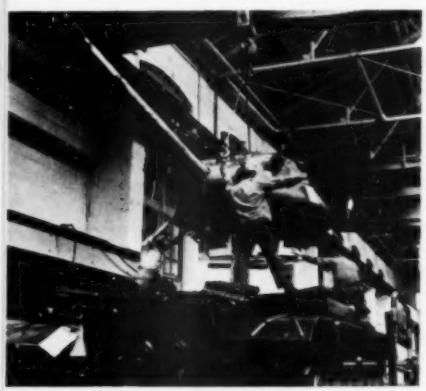


"Sunday Punch"

Waiting shipment to troops, hundreds of the Army's new lethal M47 medium tanks are massed in long lines at the American Locomotive Company tank plant at Schenectady, N. Y.

Completed M47, above, is shown on its way to the testing center. Below, tank turret with deadly 90-mm. high-velocity gun is lowered into place.

Above, a formation of M47 tanks take high-speed turn during test runs, while the 48½-ton juggernaut, below, emerges from a water obstacle designed to test its amphibious qualities.



Annealing operation on 40-mm. cartridge cases, Palace Hill plant, Quebec.

Canadian Arsenals Ltd.

Northern Organization Links Government and Industrial Facilities for Defense

Maj. Gen. J. H. MacQueen, C.B.E., C.D.

President, Canadian Arsenals Limited

FIVE years ago, Canadian Arsenals Limited celebrated its first birthday with an article appearing in ORDNANCE magazine. Quite properly, it was introduced by its proud father and first president, Col. M. P. Jolley, O.B.E., who has since left the ranks of our organization to take an executive position with a leading Canadian industrial firm.

Active Member

Colonel Jolley is a director and chairman of the Small Arms and Small Arms Ammunition Committee of the Canadian Industrial Preparedness Association which started out as the Canadian Ordnance Association, the counterpart of your American Ordnance Association.

He still takes time out to serve on our board of directors so that you will see he has by no means forgotten his "baby." It is gratifying to myself and to my associates on the board of the company to learn that the American Ordnance Association has not forgotten and is still interested in the progress of Canadian Arsenals Limited and the development of its policies during the intervening period.

The close coöperation and sympathetic understanding which we have always received from your excellent organization, the Office of the Chief of Army Ordnance, the Bureau of Naval Ordnance, and other authorities in the United States, have made our tasks much easier in these perplexing days of half-war, half-peace, and semi-standardization.

I was very pleased when, in 1946, the Right Honorable C. D. Howe, whose energy and organizing ability sparked Canadian war production during World War II and whose name is as familiar in your country as in ours, asked me to take charge of the fortunes of Canadian Arsenals Limited. It was a unique opportunity to combine selected wartime plants with the long-established Government-owned arsenals and remold them into an organization to perform functions essential to national safety and preparedness which civilian industry could not properly be called upon to carry out.

Department Formed

When the international situation deteriorated with the outbreak of hostilities in Korea, Canada had already embarked on an ambitious preparedness program. As the program gathered momentum, and as planning was turned into action, the Canadian Government formed the Department of Defense Production to execute the over-all plan.

Once again the Government called upon the Right Honorable Mr. Howe to make available his vast experience and knowledge to get the preparedness program rolling. Little time was lost translating plans into active production schedules.

The experience of the first year of Canada's 3-year 5-billion-dollar preparedness program shows that Canadian production is capable of a remarkable response to demands. Our industry has demonstrated that it can play a full part in strengthening the free world against the threat of aggression and yet maintain a free, progressive, and stable economy.

Aircraft Production

The largest part of Canada's production program is in aircraft, not only because of the responsibilities allocated to the air force itself, but also by reason of the fact that the army's program contemplates mobile airborne units and naval aviation is playing an increasing part in the operations of the Royal Canadian Navy. The aircraft requirements of the three services constitute over one-third of the whole procurement program.

Canadian Arsenals Limited is a Crown Company. The significant difference between Canadian Arsenals Limited and the Government-owned arsenals of most countries is that it is an incorporated company owned by the people of Canada, operating on the same lines as any commercial company.

This has resulted in the company establishing a sound business administration on industrial lines. Munitions are produced on a non-profit basis, but at the same time the company must be self-sustaining. Therefore, costs and production techniques are scrutinized as keenly as those of any corporation operating under the profit motive.

The field in which the company operates is one not covered by Canadian industry in peacetime. It is organized as a reserve of strategic facilities and special skills in the production of military radar, fuzes of various types, optical and fire-control instruments, small arms, machine guns, propellants, high explosives, and the manufacture and filling of all types of ammunition for the navy, the army, and the air force.

Value of Matériel

In the past 3 years, military matériel valued in excess of $37,000,000 has been produced. At present, in the 5 divisions of Canadian Arsenals Limited, 5,000 persons are engaged in production of defense requirements amounting to over $150,000,000.

Canadian Arsenals Limited directs work to private industry wherever possible, contributing to the satisfactory position of Canadian industry as a whole. For example, on the production of one type of military radar, over 80 per cent of the work is subcontracted, and on this one contract alone over 270 civilian firms will receive almost $30,000,000 for supplies and services.

The affairs of the company are in the hands of a board of ten directors, comprising men from civilian industry and representatives of the army, navy, and air force, which is responsible to the Minister of Defense Production for implementing policies laid down by the Canadian Government with respect to specific phases of industrial preparedness covered by its terms of reference.

The officers of the company are General MacQueen, president; Brig. A. Theriault, C.B.E., vice-president; E. Flexman, D.S.O., general manager; and D. C. Cullen, M.B.E., secretary-treasurer.

Financing of Canadian Arsenals Limited is arranged on lines parallel to a normal commercial company's operations in so far as its status as a government agency will permit. The capital assets are owned by the Canadian Government and are held in trust by the company.

Working Capital

Working capital is advanced from the government treasury and repaid through revenue derived from work and services performed in the various divisions of the company, mainly in fulfilling contracts for the three armed services.

The company holds, on behalf of the government, capital assets to the value of $92,000,000. In only one of the past six years has the company had sufficient business to show an operating surplus. However, the average cost to the Canadian public of maintaining buildings and services, production facilities and staff, has been $450,000 a year—less than half of one per cent of the value of the capital assets.

The foresight on the part of the Canadian Government in establishing Canadian Arsenals Limited has already borne fruit. During the present emergency it was ready to expand and assist the newly established Ministry of Defense Production to get under way more quickly than otherwise would have been possible.

While Canadian Arsenals' establishments are considerably augmented over prewar facilities, they comprise less than ten per cent of the government-owned war plants. The establishments we have retained have been the repository of single-purpose equipment and tooling, special to making weapons and munitions, cleared from 251 war contractors' plants. These are held for whatever peacetime work offers and as a pool for expanding production in an emergency. Canadian Arsenals' representatives retained and classified all available engineering data covering plant layout, operation sequences, tool drawings, shop notes, and plant histories.

Canadian Arsenals has maintained an efficient staff which, in addition to perpetuating special techniques in weapons and munitions making, has kept abreast of current developments in research and scientific warfare. It has been our aim to provide a field of endeavor for the best engineers and technicians and to inculcate in them a general competence in the specialized skills of armament making.

Various Divisions

The following paragraphs briefly outline the various divisions of the company and what they are doing.

The Dominion Arsenal Division consists of two plants, the Palace Hill plant in Quebec City and the Val Rose plant at Valcartier. Dominion Arsenal was established as a government arsenal in 1880. At the outbreak of war in 1939 it was the only government-owned munitions factory and was directly administered by the army.

The Palace Hill plant is equipped

This account of the place Canadian Arsenals Limited holds in the defense organization of Canada is both authentic and timely. Its authenticity is indicated by its distinguished authorship, for General MacQueen is well known throughout ordnance and industrial circles in the United States as well as in Canada.

The timeliness of the article is emphasized by the fact that considerable thought is being given by defense students in the United States as to the permanent form of the establishment which will guide our huge structure of Government-owned arms, atomic energy, and aircraft facilities.

Possibly the structure of Canadian Arsenals Limited points the way to a sound solution of our own huge Government-owned plant and facilities.

—The Editors.

for the manufacture of cartridge cases, primers, and other miscellaneous ammunition stores, such as metal components for small-arms' ammunition, igniters, and cartridge clips. The Val Rose plant is set up for the manufacture of all types of small-arms ammunition. This division is at present active with contracts and preparatory work on production of U.S. types of ammunition.

Small Arms Division

The Small Arms Division at Long Branch, Ontario, is equipped to manufacture or repair all small-arms equipment up to 30 millimeters, together with ancillary equipment. This covers such weapons as rifles, machine carbines, pistols, revolvers, automatic machine guns—light, medium, or heavy.

In order that the requirements of the services for these types of weapons or spare parts can readily be met, machinery of a special nature and jigs, tools, and fixtures which were used for the manufacture of various weapons during the war, are held here. Parts which can readily be produced by commercial industry, such as screws, springs, and pins, are purchased from them.

This division is currently tooling up to produce modern aircraft cannon at high production rates. Some components are already in production while full production is expected to start in July.

The Filling Division at St. Paul l'Ermite, Quebec, has facilities for the filling and assembling of shells, cartridge cases, fuzes, primers, tracers, mines, bombs, grenades, and other specialties. Production of pyrotechnic stores is limited to those types which cannot be undertaken by commercial facilities. Stand-by equipment is available for filling such munitions as depth charges, hedgehogs, and torpedo warheads. It is also possible to carry out experimental production and to make standard tests on fuzes, bombs, primers, tracers, caps, and detonators. This division has been active in filling fifteen different types of ammunition.

Preparing hedgehog bombs, Filling Division, Canadian Arsenals Limited.

The Gun Ammunition Division at Lindsay, Ontario, has facilities for the development and manufacture of metal components for gun ammunition, including shells, tracers, fuzes, and other machined components and assemblies for 20-mm. to 5.5-inch weapons inclusive, as well as mines, bombs, and grenades.

This division is engaged in production of one U.S. type of ammunition and is set up to manufacture five different kinds of ammunition simultaneously, forging on one and machining on all five. Components for two fuzes are being manufactured.

Instruments and Radar

The Instrument and Radar Division at Leaside, Ontario, is equipped for the development, manufacture, and repair of optical and nonoptical precision instruments, such as binoculars, telescopes, range finders, dial sights, predictors, and electronic and radar equipment.

Marine radar equipment, designed and manufactured for naval use during the last war, is now produced at this division for installation in any type vessel.

A sixth Division of Canadian Arsenals Limited—the Explosives Division—consists of five sections: DeSalaberry Works, Valleyfield, Quebec; Shawinigan Works, Shawinigan Falls, Quebec; St. Dominique Storage Depot, St. Dominique, Quebec; Beloeil Gun and Fuze Powder Plant, Beloeil, Quebec; and Nobel Equipment Storage, Nobel, Ontario.

Beloeil and Nobel are at present inactive, but St. Dominique is in constant use for the receipt and transshipment of propellants, explosives, and chemicals.

Defense Industries Limited, which was the wartime operator of these facilities, was engaged to carry out the rehabilitation and operation of the DeSalaberry and Shawinigan plants.

The DeSalaberry Works at Valleyfield covers some 1,800 acres and is producing smokeless powder (rifle and cannon), RDX and its various compositions. Facilities for producing cordite are being adapted to produce flashless powder. During the war this plant also produced trinitrotoluol, dinitrotoluol, and tetryl. Production is expected to start in the next few months on intermediates such as nitric acid and nitrocellulose.

The hexachlorethane works at Shawinigan Falls is actively producing smoke-generating chemicals in fulfillment of current orders.

The Gun Division

A seventh division of Canadian Arsenals Limited—the Gun Division located across the St. Lawrence River from Montreal, at Longueuil, Quebec—was set up to manufacture (exclusive of autofrettage and heat treatment of large pieces) such items for a full range

of guns, gun carriages, and gun mounts up to and including 6-inch caliber which could not be procured from private industry in Canada. In order to fulfill this function, the plant was equipped with a most up-to-date toolroom and machine shop capable of undertaking, on a large scale, general and heavy machine work.

Early in 1951, Sorel Industries Limited, which had been awarded sizable contracts for guns, required additional facilities to meet contractual requirements. The Canadian Government decided to assist the program by leasing the complete facilities at Longueuil to Sorel Industries Limited in order that this firm might fulfill its production schedules.

Plant Converted

A plant is being converted at Quebec City to provide additional facilities for the manufacture of cartridge cases with a single-shift capacity of 54,000 cases per month. This plant will be known as the Louise Basin Plant.

A $2.5 million plant is nearing completion at Scarborough, Ontario, which will be used for the final assembly and testing of all types of radar equipment, over 85 per cent of the components and subassemblies being manufactured by industry and assembled at this plant.

Development work done by Canadian Arsenals Limited is mainly confined to projects agreed on with the armed services and the Defense Research Board. Projects include new techniques of shell filling, perforated steel and light alloy cartridge cases, new types of propellant which give greater sustained pressures, shaped charges, new cap and primer compositions and new methods of pelleting these, new developments in both marine and military radar, and new techniques for steel boring not previously used in Canada. In addition the company is actively participating in the endeavor to obtain rationalization of international drawing practices and metal specifications.

At the request of the Department of National Defense the correlation of standard commercial and service ferrous alloy specifications currently in use in Australia, Canada, the United Kingdom, and the United States was undertaken and published in 1949 under the title of "Ferrous Alloy Specifications—Commercial and Service."

Specifications Compiled

A similar work is under way on compiling specifications for nonferrous metals and alloys. It is expected that this will be published later in the year.

In the manufacture of munitions, Canadian Arsenals Limited has developed new techniques and skills. For example, the Filling Division has perfected a mechanized detonator-filling apparatus which has reduced the number of operators from sixteen to eight, while greatly increasing production at the same time.

The Gun Ammunition Division, in collaboration with General Engineering Limited, developed and built an electrical induction method of heating steel billets for forging into shells. Production time for this process has been reduced from hours to a matter of minutes. This same method has been adapted for heat treatment and other shaping operations.

Electronic gaging devices have been developed at the Dominion Arsenal and Gun Ammunition Divisions for the automatic gaging of various types of ammunition at different points of manufacture, eliminating former production bottlenecks.

The Small Arms Division has installed a centralized gage-manufacturing facility to cater to special munitions-making gage requirements, particularly with regard to government acceptance gages, but some capacity will be available to help contractors should they be unable to procure their gages through commercial channels.

Skills Used

There are many other fields in which the resources, skills, and special knowledge of Canadian Arsenals Limited have been of use to Canadian industry.

Machine tools and tooling have been transferred from Canadian Arsenals' reserve to assist industry. Basic information—drawings, specifications, and manufacturing data—with respect to service equipment and stores which Canada might have to manufacture is continually being accumulated in a service-equipment index at the various Divisions. This applies to both U.K. and U.S. types of stores. At the present time, preliminary engineering studies are being carried out on U.S. types of stores, and manufacturing data will be incorporated into this index as they become available on production of U.S. types of ammunition by Canadian Arsenals Limited and industry.

In collaboration with the inspection services, considerable work has been carried out on the use of X-ray and a radioactive isotope of cobalt (cobalt 60) for detection of flaws in metals.

A large-scale antipollution waste-disposal system was installed at Valcartier, P.Q. One of the first of its kind in Canada, it neutralizes acids and other harmful effluents. A great deal of research work was undertaken in connection with this project, and details are available to industry.

Employee Relations

The company has its own employee-retirement and pension plan and supports an approved group plan of life insurance, including hospitalization and sickness benefits. Employees are also covered by accident insurance under the Employees Compensation Act. Medical and first-aid facilities, available throughout all divisions, are under constant review, and there are labor-management committees on both safety precautions and general problems.

This is the story of our part in the Canadian preparedness program. We have made great strides in the past year. Our eyes are set on the higher goal. There will be many obstacles to overcome and problems to solve. With the zeal of a young and active corporation, aided by the advice and coöperation of the American Ordnance Association and other friendly coworkers in the United States and the United Kingdom, we will continue to advance and play a fuller rôle in the rapid mobilization of Canada's industrial resources for defense.

Blueprint to Beachhead

World War II Experience Aids Present Tank Program

Robert T. Keller

THERE appears today to be a great deal of public misunderstanding of the current defense effort, arising perhaps from an unconscious comparison with the industrial accomplishments of World War II. Such comparison is bound to lead to error, for while there may be some surface resemblance between the two programs, there are also some very basic differences which should be recognized.

Differences Outlined

These differences are brought into sharp focus when one has watched a tank plant come into being, step by step, for the second time in little more than a decade. In the interest of establishing a fair appraisal of the current defense production effort, it might be helpful to outline the differences as they have materialized in the tank experience of Chrysler Corporation.

Early in January last year, the first earth-moving equipment began to prepare a site at Newark, Del., for the construction of the Chrysler Delaware Tank Plant. Ten months later the first pilot model of the T43 heavy tank was completed in that plant. Since that time, steady progress has been made in finishing the construction job and preparing the plant for volume production of the T43 and the new T48 medium tank. In many ways the road we are traveling is a familiar one, for Chrysler Corporation has been over this course once before in building, equipping, and operating the Detroit Tank Arsenal during World War II.

Mr. Keller is general manager of the Chrysler Delaware Tank Plant. He was active in Chrysler's World War II tank program and has supervised the construction of the Delaware Tank Plant.

Chrysler received its first tank order in August 1940. It built the Detroit Tank Arsenal and delivered the first tank eight months later, in April 1941. By the end of 1942, the arsenal had reached a peak output of 896 tanks a month.

25,000 Tanks

In the 4½ years following delivery of its first tank, the Chrysler Tank Arsenal delivered to the U. S. armed forces and to our Allies more than 25,000 tanks of 12 different types and more than 3,100 carloads of tank replacement parts.

At peak employment, 25,000 Chrysler workers at the arsenal and in 11 other Chrysler plants throughout the Nation were engaged in tank work. In addition, the number of suppliers and subcontractors for the arsenal numbered in the thousands. Meanwhile, the Chrysler Engineering Division

conducted more than 1,100 separate engineering projects for Army Ordnance.

At the end of the war the corporation turned the arsenal over to the Army, giving it for the first time a modern, self-contained plant for the peacetime design, repair, building, and testing of armored vehicles. The importance of this permanent addition to the Army's arsenals can best be appreciated by the fact that between 1919 and 1938 the Army had built just eighteen tanks, and no two of them were alike.

Since the war, the tank arsenal in Army hands has been a vital part of our national security. World War II tanks, modified and improved at the arsenal in the postwar period, have been very important factors in the fighting in Korea. In addition, the research and liaison with industry during this period have been of tremendous help in getting industry started on the present defense program.

In reviewing the accomplishments of the Detroit Tank Arsenal during World War II, it should not be inferred that a parallel performance from the Delaware Tank Plant can be expected. There are many differences between the two programs which must be taken into account.

Two Purposes

The first of these differences is the very concept of the current preparedness program. The present program has two very important purposes. One is to fill the urgent need for limited quantities of military goods right now. The other is a long-range plan of creating facilities capable of turning out large quantities of military goods if the need should ever arise in the future.

The World War II program, from its very start, was aimed at getting specified quantities of military goods. Generally speaking, the quantities demanded kept increasing as the means to produce them became available.

Today we are asked by the Government to prepare facilities which are capable of turning out a given number of tanks in a month, but our orders for finished tanks are for only a fraction of that number each month.

Must Be Ready

Of course, there are sound reasons for this difference between the World War II program and the current preparedness program. For the long run, we want to be ready for an all-out mobilization. The need for an all-out effort is not here yet, and we hope, by being ready, to prevent that need from ever materializing. At the same time, we have a pressing need for limited quantities of arms in the field today. Meeting this double requirement is a delicate job, and it creates some peculiar problems.

For example, take the matter of suppliers and subcontractors. It is one thing to get a supplier for a critical item if we are to go to 100 per cent of our capacity indefinitely and quite another if military needs require operations at 10, 50, or 75 per cent of capacity for a limited time. Many manufacturers who have the potential for taking care of our maximum needs just cannot afford to invest in the equipment and tie up floor space for a small fraction of those needs when they have no assurance of future volume orders.

This problem cuts down the number of potential suppliers. As a matter of fact, we have had to take some work into our plant that originally was intended for outside sources.

To complicate matters, we also have this problem in reverse. There are cases where available suppliers can provide us in the limited quantities we shall need in the immediate future but who will not have the facilities available to supply us on an all-out basis.

This simply means that, no matter how careful the preliminary planning, we are not going to create a complete stand-by facility that can be stepped up to full capacity merely by pushing a button. In an all-out effort we shall still have to face the problem of limited availability of materials and qualified suppliers to meet the increased schedules. In that event, all the other defense prime contractors will probably be in the market, too.

Several Differences

There are several differences between our World War II and present tank programs as a result of the widely different economic circumstances of the two eras. We started building the Delaware Tank Plant last year after several years of an unprecedented boom in construction throughout the Nation. On the other hand, when we started to build the Detroit Tank Arsenal in 1940 we were working on the Nation's first major defense plant at the end of a long period of doldrums in construction.

The whole problem of central economic controls was barely in its infancy in 1940. Today the maze of regula-

Completion of the steel framework for the Delaware Tank Plant is marked as R. T. Keller fastens the flag to the last steel truss on August 10, 1951.

tions, price controls, allocations, and directives has had twelve years to grow into full bloom. These restrictions have created problems in getting the Delaware Tank Plant built that we didn't dream of when we were building the Detroit Tank Arsenal.

Many Delays

The attempt today has been to superimpose a vast program of defense preparations on an extremely active civilian economy without completely upsetting that economy. In such a complicated and tremendous undertaking we are bound to get our wires crossed and become short-circuited now and then. As a result, we run into countless delays in getting construction materials, machines, tools, raw materials, and finished parts. These are problems we didn't have in 1940, at least not to the extent we have today.

However, on the other side of the ledger we enjoy some advantages today that we didn't have in 1940. One of the most important of these is experience.

When our World War II tank assignment was in the talking stage back in the summer of 1940, I was in a group of Chrysler people taken to the Rock Island Arsenal, Ill., to look at a tank. I doubt if very many of us had ever seen a tank at close range before. We were starting from scratch to lay out and build the first tank-manufacturing plant this country ever had.

Less than a year later that plant was a reality, and in another year it was turning out more tanks in one day than had been built in this country in the entire nineteen years following the first World War.

We learned a lot about producing tanks during the war, and that knowledge has proved extremely valuable in the present defense program. We also learned a great deal about engineering tanks through our development work during the war, so that in the present emergency the Chrysler Corporation Engineering Division was able to take on the job of designing the new T48 medium tank for the Army and play an important part in the design of the new T43 heavy tank.

Above, workmen install 120-inch vertical boring mill at the Delaware Tank Plant. This vital 100,000-pound piece of equipment was in operation within 24 hours.

Mixed Blessing

Actually our increased knowledge of tanks is probably a mixed blessing from a manufacturing standpoint. As a result of experience in action during the last war and continued development and research, the tanks being turned out in 1945 were far superior to the 1941 product. Lessons learned during and since the war have placed new demands on tank designers, and the modern tanks are far more complicated than their most advanced World War II predecessors.

They also present greater manufacturing problems. For instance, new fire-control apparatus is required in which one sighting device alone is many times more difficult and takes many times more man-hours to produce than the entire fire-control system of the World War II tank.

Suppliers Limited

Some of the new features on our modern tanks have by their nature reduced the number of suppliers who are able to produce them. A one-piece cast-armor hull, for example, cannot be produced by every supplier who was able to provide components for the World War II welded or riveted hulls.

For all these increased manufacturing problems, though, the tanks that will come out of the present defense effort will be better than anything we have ever had before. This is because they were designed out of practical experience on the battle line and in the factory.

We went into our World War II preparations armed with our experience in building automobiles and we had to translate this into tank-building knowledge. From our first trip to the Rock Island Arsenal we brought back to Detroit 186 pounds of blueprints of the tank we were asked to build. Wooden parts were made from these blueprints and assembled into a full-sized mock-up of the tank to give us our first physical contact with tank building.

Come a Long Way

We had come a long way by 1950 when Ordnance came to us, laid on the line what they wanted in a tank, and asked us to go ahead and design it for them.

There were no previous patterns to guide the layout and construction of the Detroit Tank Arsenal in 1940. No tanks had ever been built by assembly-line methods in this country up to that time.

The Detroit Tank Arsenal began as a self-contained unit for building tanks at the rate of five a day. It was planned to do most of its own machining as

well as the final assembly. As the pressure for more and more tanks increased, more machining and subassembly work was moved to other plants, until four assembly lines were running at the arsenal and the production rate was about six times that originally planned. As the need for volume slackened, the assembly lines shrunk and the farmed-out work was brought back into the plant.

In building the Delaware Tank Plant, we have had the evolution of the Detroit Tank Arsenal to serve as a guide. We have been able to avoid many of the problems which arose due to lack of experience when we traveled this road the first time.

One example is our tank test track over which each vehicle must be driven for fifty miles before it can be turned over to the Army. We built our first test track at the Detroit Arsenal, and before World War II was over, we had made innumerable repairs on that track and had built two others. This is understandable when you realize that the tanks under test covered a total of some 2,000,000 miles.

First Test Track

Our first test track at Detroit was built of reënforced concrete. When it was designed, these factors were taken into consideration: the tanks to be tested were to weigh between 25 and 30 tons; our contract was for only about 1,000 tanks, and these tanks were to be equipped with rubber caterpillar shoes. But things turned out to be other than we had contemplated.

As tank designs changed, the vehicles became heavier—some of them which we built at Detroit weighed about forty-five tons. Furthermore, as the war progressed, a shortage of rubber developed, and rubber shoes were replaced by steel treads. And, of course, we built and ran over the track many times the number of tanks we had anticipated.

Track Disintegrated

The result was what one would expect. The original test track began to disintegrate under the constant pounding it took. We first endeavored to repair it with crushed stone, slag, and gravel, but it wouldn't hold up. Then we built a dirt track on the outside of the original one. With weather conditions being what they are in Michigan, that track was usually either a quagmire or a dust bowl, and it failed to hold up.

Finally, in collaboration with the Corps of Army Engineers, we built an entirely new test track. It consisted of an asphaltic concrete surface on a subgrade of gravel and crushed stone. Instead of a hard, brittle surface, we then had a somewhat resilient surface which withstood quite successfully the constant pounding of steel treads on heavy tanks, and it was also easier to maintain and repair. That track in Detroit is still in use.

When we designed our test track for Newark, we had a vast amount of experience which we utilized. The present tank test track is built of asphaltic concrete on a subgrade of various layers of sand, gravel, and crushed stone with each layer being of a fixed thickness. In fact, our subgrade for the new track has a total thickness of between fifty and fifty-four inches.

But because we learned from experience that no tank test track will hold up indefinitely under the constant pounding it must take, our track is laid out so as to provide for the contingencies of maintenance.

During World War II we were presented with many engineering changes and new requirements in the rate of production. Those problems will still be with us. Such changes involve difficult and costly rearrangements of machinery.

Unique Floor

At the Delaware Tank Plant we have constructed an 8-inch, double-reënforced concrete floor topped with 4-inch wood blocks. This arrangement eliminates the need for machine foundations and provides us with a greater flexibility of planned layout should it be necessary to rearrange our machines to meet new production requirements.

Our interest in tanks didn't end when we turned the Detroit Arsenal back to the Army in 1945. In the postwar period we kept in touch with the changing developments in the tank field. Long before embarking on the present tank program we conducted two important study programs for the Army to determine the current economic and physical requirements for mobilization for tank production.

Important Advantage

Finally, another important advantage we have today is the working partnership between Ordnance and industry which grew up during World War II. Though it is intangible and cannot be measured, this relationship is a real and vital asset to our present defense effort.

Only precedent for the Delaware plant was the Detroit Tank Arsenal shown below in June 1944 as it hit peak production with five assembly lines in operation.

Military Socialism

Present Preparedness Costs May Cause Our Own Defeat

by

Robert W. Johnson

"When the fight for freedom becomes a flight to socialism, we should review our course. Our most important problem is to balance a free economy on the one hand and an adequate system of defense on the other."

BY tradition, by the record, and in modern fact, military men on the ground, on the sea, and in the air are politically conservative. We can be proud that there are few socialists in uniform.

Most informed persons grant that our educational system has its pinkish areas. But such is not the case at West Point and Annapolis. These two schools can stand the piercing searchlight of investigation into their ideological policies. Having disposed of any suspicion that socialism has been trained into our military personnel, let us now look at the issues of the day.

Merger Not Complete

The merger of the services is not complete. To unify three great military establishments into a balanced whole is an undertaking requiring time, patience, and evolution. We are on the way, however, and it may be that the ultimate design will not be a merger in the accepted sense of the term but rather a new form of coördinated partnership, using the task-force concept.

In its final form, a coördinated defense should (1) improve the competence and effectiveness of our military power and (2) reduce its cost.

Honest differences exist. We have those traditionalists who are naturally reluctant to give up one weapon until a new weapon has been proved. This is a reasonable and conservative attitude which, like others, can be carried to extremes, as in the case of the outmoded battleship.

Cut the Cloth to Fit

To aid us in our thinking, let's reduce it to the problem of a family or a free business. As families and as business groups, we can't have everything we want, nor can we always fill the needs of those who see only their specialized zones of responsibility. We must cut the cloth to fit our resources. So must the Nation.

When the fight for freedom becomes a flight to socialism, we should review our course. Our most important problem is to balance a free economy on the one hand and an adequate system of defense on the other. Here we face as many opinions as we have leaders in the civilian and military fields. Of course the subject is controversial, but so are most subjects in the twentieth century. Now that we have acknowledged the fact of controversiality, our next duty is to face the issue with intelligence, equity, and common sense.

The point has probably been reached where we should reverse the usual method of procedure. We should first decide on the amount we can afford to spend and then spend this sum in the most economical and effective manner.

Technical questions will bemuse us. And here the Armed Services Committees of the House of Representatives and the Senate are expected to give expert counsel. We are fortunate to have a number of experienced men on these committees. After the Joint Chiefs of Staff and the Secretary of Defense have done their best, the Congressional groups should, and to some extent do, bring the program to reality.

It is not enough for the Joint Chiefs and the Secretary of Defense to submit an inflated program with the realization that the Armed Services Committees will cut it down to size. There is too much of this sort of thing today.

Must Be Objective

We can follow the practice of the mule trader where the owner of the mule asks too much and the buyer offers too little, or we can choose the more objective course. In the mule-trading business, we follow the technique of the oriental bazaar rather than that of intelligent evaluation. Admittedly it takes two to make a bargain, and therefore both those who ask for money and those who appropriate money should deal with facts and give up the barter approach.

Our military leadership has a new responsibility in these times of colossal expenditure. These men in uniform are still citizens of the United States and as such must strive to submit programs to the Congress within the limits of the Nation's pocketbook. Otherwise, expenditures will become so great that the ideology of the enemy will be forced on the loyal citizens who are giving their all to defeat it.

A Strange Thing

It is strange indeed that a group of men opposed to socialism and charged with the defense of their country should, in creating that defense,

General Johnson, who served with distinction in the Second World War, has experience not only in military affairs but is outstanding among industrial leaders. He is chairman of the board of Johnson & Johnson, New Brunswick, N.J.

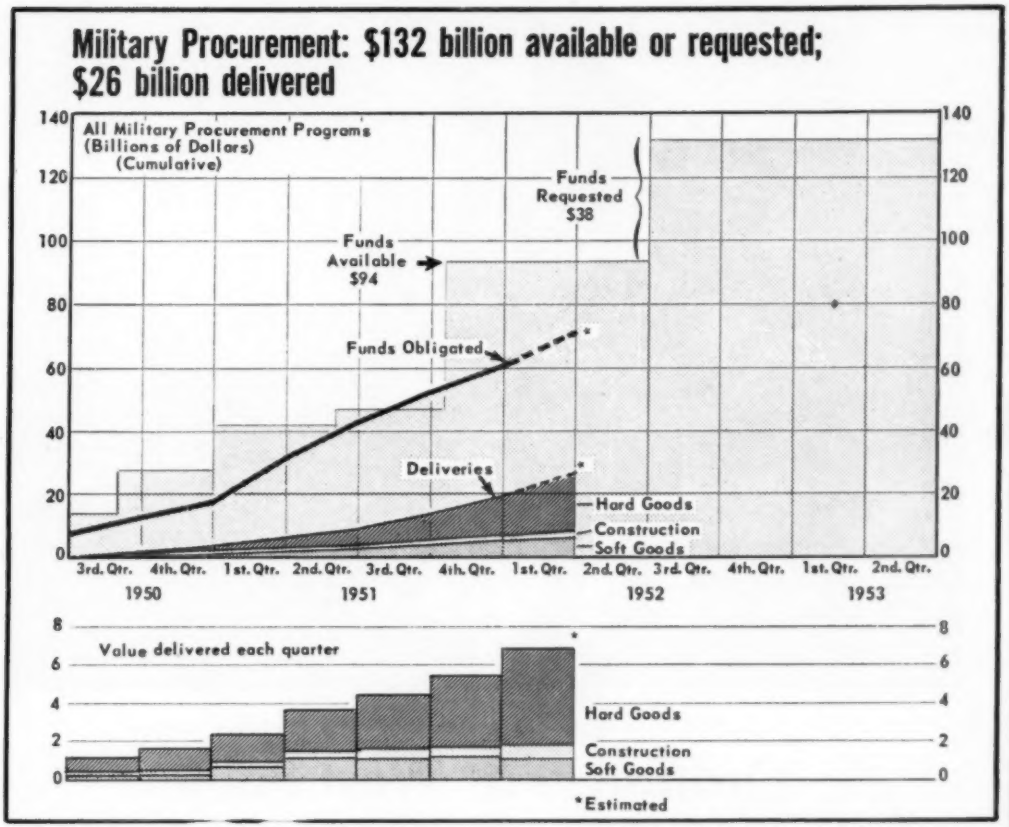

Military Procurement: $132 billion available or requested; $26 billion delivered
All Military Procurement Programs (Billions of Dollars) (Cumulative)
Funds Requested $38
Funds Available $94
Funds Obligated
Deliveries
Hard Goods
Construction
Soft Goods
3rd. Qtr. 4th. Qtr. 1st. Qtr. 2nd. Qtr. 3rd. Qtr. 4th. Qtr. 1st. Qtr. 2nd. Qtr. 3rd. Qtr. 4th. Qtr. 1st. Qtr. 2nd. Qtr.
1950 1951 1952 1953
Value delivered each quarter
Hard Goods
Construction
Soft Goods
*Estimated

Chart of military procurement showing funds available or requested and the value of goods delivered up to April 1, 1952.

threaten us with socialism here at home.

As an important segment of society, military leaders should recognize that the country faces a towering pyramid of debt. Three wars have consumed our savings and mortgaged our future. On top of all this totters the staggering costs of the welfare state. Now we plan to superimpose the gigantic figures of modern defense.

Write the Tax Bill

Few military men realize that they are writing a tax bill when preparing tables of requirements. These officers, however, are in truth creating the tax demands of the Nation. Procurement officials, military and civilian, should always think of the 42,000,000 income-tax payers, the millions of businesses paying profits taxes, and the 150,000,000 excise-tax payers. Every order for military armament, naval stores, and army supplies is in fact another grab at the housewife's pocketbook.

Major Problem

A problem of the first magnitude has emerged which requires the ingenuity of our best men in and out of government. Surely only a mood of stark realism can conquer such vicissitudes.

As an historic generality, in both ancient and modern times excessive military expenditures have ended in despotism of monarchical, fascist, or socialist form.

Militarism led to the downfall of ancient Greece and Rome. In Germany and Italy excessive military spending led to inflation and then to chaos. The fear of socialism paved the way for fascist domination.

The military costs of two world wars shook Great Britain's financial stability. The door to socialist policies was opened under Clement Attlee.

Our hope, therefore, lies in the development of a balanced program within the financial capacity of our country. As this capacity is augmented each year through the one device of greater productivity per man hour we can increase that portion spent on defense without the threat of a socialized state here at home.

The Challenge

Individually and in private groups we have the competence, the manpower, the facilities, and the resources to meet the demands of defense and to pay our debts at the same time. This is the challenge of the day—the challenge that faces military leadership.

Ordnance at West Point

Cadets Receive Thorough Training in Modern Weapons

Col. John D. Billingsley

Professor of Ordnance, United States Military Academy, West Point, N. Y.

FOR a century and a half the United States Military Academy at West Point has been responsible for providing the Nation with graduates possessing the basic knowledge, qualities, and character required for progressive development as career officers of the Regular Army.

Continuous Evolution

This responsibility has been met by a continuous evolution and development of the Academy's curriculum, and in no field of instruction have greater changes occurred than in that which deals with the vital tools of war—ordnance.

The importance of instruction of the cadet in ordnance was clearly stated by Gen. J. Lawton Collins, Army Chief of Staff, at the Founder's Day Exercises held at West Point on March 16, 1952, when he said:

New Developments

"A new framework of national defense is being created because of new developments in weapons that completely astound even the most optimistic military planners. Guided missiles, atomic weapons, jet aircraft, and tremendously powerful ammunition are among these developments, and their implications are so vast and their potential so promising that if we are not careful it is possible that our total national effort could be directed into one specific system to the detriment of other systems which, in time, might prove even more effective."

Thus it becomes increasingly important that our future military leaders secure a basic foundation upon which to build their understanding of modern and future weapons.

Understanding Essential

An understanding of the engineering principles embodied in new weapons, and their effective evaluation, is essential for every good officer, regardless of branch assignment. Admiral Mahan stated many years ago:

"The student will observe that

changes in tactics have not only taken place after changes in weapons, which necessarily is the case, but that the interval between such changes is unduly long. This doubtless arises from the fact that our improvement of weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil. It can be remedied only by a candid recognition of each change."

The course in ordnance and related activities at the Military Academy must make this recognition by its graduates possible.

Gradual Growth

The present Department of Ordnance at the Military Academy represents a gradual growth from the Department of Artillery and the Department of Ordnance and Science of Gunnery. In the earlier stages of development the instruction was mostly practical, and little is known of it prior to 1812. Of the period from 1812 to 1817 General Cullum writes: "Tactics of infantry and artillery were Captain Partridge's delight, and were well taught, but were necessarily limited, owing to the small number of cadets to exercise and the few pieces of ordnance for drill or target practice."

The Department of Artillery first appears upon the records in 1817, the first instructor being 2nd Lieut. George W. Gardiner, Corps of Artillery, whose tour of duty extended from September 15, 1817, to February 1, 1820. During part of this time he was also commandant of cadets. In 1821, the instructor in artillery was made a member of the Academic Board.

More Theoretical

From 1820 to 1857, the artillery course gradually became more theoretical and less practical. In 1826, the scientific portion of the course was transferred from the Department of Engineering under the head of "Science of Artillery." In 1839 pyrotechny was added, together with instruction in the manufacture of gunpowder, percussion powder, cannon, and projectiles.

In 1857 the Department of Ordnance and Science of Gunnery was organized pursuant to the following resolution of the Academic Board of December 5, 1856:

Separate Department

"That the portion of the present course of artillery which comprises the science of gunnery, and what is known in our service as ordnance, be disconnected from that which relates to tactics merely, and be made the subject of a separate department, and that the additional time necessary for the development and improvement of this department be taken from that now given to practical engineering in October."

By December 9, 1856, the course was arranged as follows: "Ordnance and gunnery from 11 A.M. to 1 P.M. from October 1st to the end of the first week in March, alternating every other week day with cavalry tactics during October and two weeks in November, and with riding during the remainder of the term."

The academic regulations of 1857 provided for the detail of the instructor of Ordnance and Science of Gunnery and constituted him a member of the Academic Board. Capt. James G. Benton, Ord. Dept., was assigned to duty at West Point and became the first professor of ordnance and science of gunnery there.

The unusual ability of Captain Benton as the first professor of ordnance and science of gunnery gave an organizational form and content to the course of instruction that was felt during the next half century. His textbook, "Ordnance and Gunnery," published first in 1861, was well known as a model book and furnished the basis of most of the subsequent texts. It is interesting to note that the U. S. Naval Academy's first ordnance text was also published in 1861.

The first of the revisions was made by Capt. Alfred Mordecai, Ord. Dept., who published a series of pamphlets taking up the different chapters of Benton in detail and bringing them up to date. His intention upon the completion of the work was to publish it in book form, but unfortunately he was relieved from duty before this work was accomplished.

The course for some years after Mordecai's tour consisted of his pamphlets and those parts of Benton which still applied, supplemented by notes published by Maj. Clifton Comly, who succeeded him.

Course Revised

Capt. Henry Metcalfe, who succeeded Major Comly, found that the course needed a thorough revision, and he proceeded with the work and finally pub-

Name	*Class*	*Rank and Regiment*	*Tour of Duty*
George W. Gardiner	1814	2nd Lieut., Corps of Artillery	Sept. 17, 1817, to Feb. 1, 1820
Fabius Whiting	Non-grad.	Capt., Corps of Artillery	Aug. 15, 1820, to Aug. 7, 1821
Z. J. D. Kinsley	1819	2nd Lieut., 3rd Artillery	Dec. 18, 1823, to Dec. 1, 1835
Robert Anderson[1]	1825	1st Lieut., 3rd Artillery	Dec. 1, 1835, to Nov. 6, 1837
Minor Knowlton	1829	1st Lieut., 1st Artillery	Nov. 9, 1837, to July 1, 1844
E. D. Keyes	1832	Capt., 3rd Artillery	July 25, 1844, to Dec. 24, 1848
William H. Shover	1838	Capt., 3rd Artillery and brevet maj., U.S.A.	Dec. 24, 1848, to Sept. 7, 1850
George H. Thomas[2]	1840	1st Lieut., 3rd Artillery, and brevet maj., U.S.A.	Apr. 2, 1851, to May 1, 1854
Fitz John Porter[3]	1845	1st Lieut., 4th Artillery, and brevet maj., U.S.A.	May 1, 1854, to Sept. 11, 1855
Henry F. Clarke	1842	1st Lieut., 2nd Artillery, and brevet capt., U.S.A.	Sept. 11, 1855, to Aug. 6, 1856

1. Union commander at Fort Sumter, 1861.
2. "Rock of Chickamauga."
3. New York City Police Commissioner, 1884.

Instructors in Artillery at the United States Military Academy, 1817-1856.

lished his "Ordnance and Gunnery," which remained a textbook until 1896. When Captain Metcalfe's book was written the artillery system of the United States was in embryo as was the subject of small arms and certain other aspects of ordnance.

Shortly after his relief from duty in 1891, all these factors in the ordnance field assumed definite shape. The system of artillery, guns, and carriages, became somewhat stabilized, a new small arm was adopted, smokeless powders came into vogue, and many other minor changes were made.

Further Revision

These changes necessitated a further revision of the course. The result was the publication in 1898 of a textbook, "Ordnance and Gunnery," by Capt. L. L. Bruff, professor of ordnance and science of gunnery at the Academy.

The next fifty years saw the course in ordnance and gunnery survive two drastic cuts in allocated time due to the reduction in the length of the course at the Military Academy resulting from the two World Wars.

Immediately prior to World War I the text in use was one by Lieut. Col. Ormond H. Lissak, professor from 1904 to 1908. As the war clouds gathered over Europe in 1914 the incumbent professor, Lieut. Col. William H. Tschappat, recognized the serious need for a new textbook.

This revision was made necessary by the stepped-up development program resulting from the production by American manufacturers and the probable adoption by the United States services of many items of European equipment.

Colonel Tschappat's revision was published in 1917. Unfortunately, its publication coincided with the suspension of the course in ordnance and gunnery and the absorption of certain of its descriptive subjects by the Department of Tactics during the accelerated instruction of the war classes.

Name	*Class*	*Rank when Appointed*	*Term of Service*
James G. Benton	1842	Capt.	Feb. 27, 1857, to Apr. 26, 1861
Stephen V. Benét[1]	1849	1st Lieut.	Apr. 26, 1861, to Feb. 1, 1864
Thomas J. Treadwell	1854	Capt.	Feb. 11, 1864, to Sept. 13, 1864
George T. Balch[2]	1851	Capt.	Feb. 22, 1864, to July 12, 1865
Alfred Mordecai	1861	Capt.	July 12, 1865, to Aug. 2, 1869
Theodore Edson	1860	Maj.	Aug. 2, 1869, to Nov. 17, 1870
Thomas C. Bradford	1861	Capt.	Jan. 1, 1871, to Jan. 12, 1872
Stephen C. Lyford	1861	Capt.	Jan. 30, 1872, to June 28, 1872
John R. McGinness	1863	Capt.	July 25, 1872, to Aug. 30, 1874
Alfred Mordecai	1861	Maj.	Aug. 30, 1874, to Aug. 28, 1881
Clifton Comly	1862	Maj.	Aug. 28, 1881, to Aug. 28, 1886
Henry Metcalfe[3]	1868	Capt.	Aug. 28, 1886, to Aug. 8, 1891
Lawrence L. Bruff	1876	Capt.	Aug. 17, 1891, to Aug. 14, 1900
Frank E. Hobbs	1878	Capt.	Aug. 15, 1900, to July 1, 1904
Ormond E. Lissak	1882	Capt.	July 1, 1904, to Apr. 10, 1908
Edward P. O'Hern[4]	1894	Lieut. Col.	Apr. 10, 1908, to Aug. 21, 1908
Colden L'H. Ruggles[4]	1890	Lieut. Col.	Aug. 21, 1908, to June 30, 1911
William H. Tschappat[1]	1896	Lieut. Col.	May 1, 1912, to July 8, 1917 and Feb. 20, 1918, to July 10, 1918
Charles G. Mettler	1906	Lieut. Col.	Sept. 2, 1920, to June 14, 1924
Earl McFarland[4]	1906	Lieut. Col.	June 15, 1924, to Aug. 24, 1929
Alexander G. Gillespie[4]	1906	Lieut. Col.	Aug. 30, 1929, to Aug. 20, 1933
Thomas J. Hayes[4]	1912	Lieut. Col.	Aug. 21, 1933, to July 15, 1938
Oscar J. Gatchell	1912	Lieut. Col.	July 15, 1938, to Aug. 1, 1940
Lawrence C. Leonard	1922	Lieut. Col.	Aug. 1, 1940, to Jan. 2, 1942

1. Later Chief of Ordnance.
2. With Erie Railroad, 1872-1878.
3. Inventor of first detachable magazine for small arms.
4. Later Assistant Chief of Ordnance.

Heads of the Department of Ordnance and Science of Gunnery, 1857-1942.

During the period July 1917 to September 1920 there was no professor of ordnance except for a short time during 1918 when Colonel Tschappat was so designated.

In 1921 the course was reëstablished for the Class of 1922, with Lieut. Col. Charles G. Mettler as professor. Tschappat's text was used as the basis for the course.

New Matériel

Lieut. Col. Earl McFarland succeeded Colonel Mettler as professor in 1924 and recognized the importance of including coverage of combat vehicles and other World War I developments. In 1929 Colonel McFarland published a revised text incorporating new ordnance matériel, and at the same time greater stress in the course was placed on shop and laboratory work. This period was marked by an increase in machine-shop practice, and cadets learned to operate most of the more common machine tools.

The concept of the course in the 'thirties was the study of basic principles and fundamental theories, and the construction, operation, and use of standard service weapons and related equipment, supplemented by practical work in shops and laboratories.

The efforts of various nations to increase the firepower, mobility, and general combat effectiveness of their armed forces through improvement in their material and the use of new processes, techniques, and materials employed made necessary further revision of the subject matter of the course.

Hayes' Text

This requirement resulted in the publication in 1938 of a revised text, "Elements of Ordnance," by Lieut. Col. Thomas J. Hayes, professor of ordnance. This text, incidentally was the last single-volume text prepared for use in the course in ordnance and gunnery at the Military Academy.

By 1940 the heads of all academic departments, except the Department of Ordnance and Science of Gunnery and the Department of Law, were perma-

nent professors. Lieut. Col. Oscar J. Gatchell, professor in this department, was appointed permanent professor of mechanics, and Lieut. Col. Lawrence C. Leonard succeeded him as professor of ordnance and science of gunnery.

The years 1940 to 1950 saw many changes take place at West Point due to World War II and its influence on the organization, curriculum, and operation of the Military Academy. As would be expected, these changes had a major impact on the Department of Ordnance and Science of Gunnery.

Duties Lightened

Upon the recommendation of each professor of ordnance and gunnery after 1938, in 1941 the professor of ordnance and gunnery was relieved of his additional duty as Post Ordnance Officer, Range Officer, and Chemical Warfare Officer. This freed him of an ever-increasing administrative load and permitted concentration on departmental matters. Later, in 1945, the professor was relieved as Officer in Charge of the West Point Museum, which further freed him of outside responsibility.

On January 2, 1942, the name of the department was changed to Department of Ordnance, since most of the instruction in the science of gunnery had given way to more emphasis on the engineering and functioning aspects of matériel. Colonel Leonard continued as head of the department and became the first professor of ordnance.

By Congressional action in 1947 the heads of the Department of Ordnance and the Department of Law became permanent professorships and Col. John W. Coffey became the first permanent professor of ordnance. Following his untimely death, March 8, 1951, he was succeeded by the present incumbent.

Three-Year Course

The academic year 1942-1943 brought the transition from a 4- to a 3-year course at the Military Academy. One class graduated in January 1943 and a second in June 1943. The division into air and ground cadets also took place during this year.

Cadets learn automotive engineering through laboratory practice.

The mission of the Department of Ordnance was not changed by World War II. Accomplishing its mission in about half the time became a problem of eliminating all but the most essential subject matter. Machine tool laboratory instruction was dropped from the curriculum. After the Class of June 1943, automotive instruction was transferred to the Department of Tactics.

More Instruction

In 1947 ordnance was given ninety-three periods of instruction when the 4-year course was reinstituted for the Class of 1948, and automotive instruction was transferred back from the Department of Tactics. The entire First Class took the full course since there no longer was a separation into air and ground cadets. Hayes' "Elements of Ordnance" continued to be used as a basic text through the year 1948-1949. Since that time, texts prepared by the Department of Ordnance have replaced it in its entirety.

The current courses in ordnance are designed to teach the student how to apply basic scientific principles and fundamental theories to the design, construction, and functioning of military weapons and automotive equipment. Introduction is made to the engineering and industrial problems involved in the manufacture of these weapons and equipment. The student is oriented on modern trends of research and development in all fields of military combat matériel and acquainted with the need for weighing advantages of costly new military developments in terms of the drain on the resources of the Nation (skilled manpower, critical materials, industrial plants and equipment) as well as the value to the country in military operations.

Opportunity is given for the application of certain of the principles studied in previous courses in physics, chemistry, electricity, and mechanics. Emphasis is placed on developing in each student a facility for logical, critical, and independent thought in the field of ordnance.

Automotive Laboratory

During the laboratory periods, except in automotive matériel, instruction is largely by demonstration rather than having the cadets perform actual experiments. In the automotive engine laboratory each cadet is assigned to a group of four, and each group works on its individual engine for the entire laboratory course.

Extensive use is made of training aids, cutaway models, and components in various stages of production through-

out the course. These aids are secured by local fabrication, purchase, or by donation from various manufacturers and arsenals.

Instruction Staff

The present instruction staff consists of a permanent professor and eleven detailed officers. The detailed officers are made up of eight from the Ordnance Corps, one Artillery, one Engineer Corps, and one Air Force officer, of whom three are Reserve Officers on active duty and only seven are graduates of the Military Academy.

In general the instructors have had college postgraduate work in such subjects as mechanical engineering and mathematics or are graduates of service schools.

Five of them hold master of science degrees, the others, bachelor of science. There are graduates of the Ordnance School, Guided Missiles School, Command and General Staff College, and National War College. In order not to be inbred the instruction staff consists of former students of Michigan, Georgia Tech, Maine, Cornell, Harvard, Florida, and M.I.T.

As has been previously mentioned, text material consists largely of pamphlets prepared locally by the instruction staff. Each pamphlet is revised annually and after each such revision is reviewed by some outside agency or activity in order to insure the proper coverage and factual up-to-date information. Present plans are for the consolidation of the numerous pamphlets into one loose-leaf text which will be revised annually.

In order to augment the instruction staff with experts in various fields, requests are placed on other military agencies, industrial corporations, and educational institutions for lectures and demonstrations covering certain aspects of the course. During the academic year 1951-1952, eighteen outside lecturers will participate in cadet instruction in ordnance. Most of these will cover specialized portions of the course and will make their presentations during regular class time.

Name	*Class*	*Rank when Appointed*	*Term of Service*
Lawrence C. Leonard	1922	Lieut. Col.	Jan. 2, 1942, to Mar. 26, 1947
John W. Coffey	Aug. 1917	Col.	Mar. 27, 1947, to Mar. 8, 1951
John D. Billingsley	1928	Col.	July 26, 1951, to present

Heads of the Department of Ordnance at West Point, 1942 to the present.

Included in the program of outside lectures are 8 senior officers who will cover ordnance activities in the three services for the 150 cadets exempted from the written general reviews. This coverage will be presented by means of panel discussions of the various aspects of ordnance.

The final regularly scheduled activity of the Department of Ordnance each year is a field trip to Aberdeen Proving Ground, Md. This year a stop will be made at Frankford Arsenal, Philadelphia, for the purpose of viewing the small-arms ammunition production line and the manufacture of artillery shells.

Aberdeen Program

At Aberdeen there will be a demonstration of new equipment and a night firing display of the various weapons. The program presented by the proving ground lasts from early morning to late evening and is looked upon as a fitting climax for the course in ordnance.

Other activities at the Military Academy make material contributions to the ordnance education of a West Point graduate, and the academic departments incorporate in their courses problems and background material related to ordnance. The Tactical Department devotes considerable time to the operation and employment of ordnance matériel.

Opportunity Offered

The cadets have an opportunity to observe the normal functioning of the post ordnance organization and to visit its facilities. During the summer training periods ordnance maintenance support is rendered by post Ordnance personnel in support of summer camp.

For those cadets who desire to examine old weapons and models of previously used items of ordnance matériel, the West Point Museum offers ample opportunity for them to do so. This activity was formerly under the jurisdiction of the professor of ordnance and is therefore the depository of many items of historical value. Frequent use is made by the Department of Ordnance of museum items for regular instructional use.

Club Organized

In the fall of 1951 the Cadet Ordnance Club was authorized and organized. Cadet Paul A. Gray was elected president. Membership is not limited to the First Class—all upper classmen being eligible. The club has been quite active in sponsoring a wide variety of functions pertaining to ordnance. It has sponsored an automotive workshop, encouraged the utilization of the small-arms and machine shops by its members, and has had guest speakers on ordnance subjects for twelve of its meetings. It is expected that as this extracurricular activity becomes better established more diversified projects will be sponsored.

Assistance Given

Many agencies, both governmental and civilian, have contributed to the Department of Ordnance by giving freely of information and providing material assistance. Frequent visits of industrial and civilian leaders, notably officers and members of the American Ordnance Association, have permitted contact of the instruction staff and members of the Corps of Cadets with American industry.

The story of the evolution of ordnance instruction given at West Point during the 150 years since the founding of the United States Military Academy emphasizes the typical progressive development of courses in the accomplishment of the Academy's mission.

CIVIL DEFENSE

means

SELF-DEFENSE

Today our industrial installations are faced with the necessity of organizing against atomic war

Gerald R. Gallagher

Assistant Administrator for Technical Operations
Federal Civil Defense Administration

AMERICA's industrial installations rate high in the matter of self-protection. There is reason to believe that the unsurpassed quality and quantity of their production stem in part from the carefully organized protection and care for the physical plant, the equipment, the records, and the workers.

Models of Efficiency

In many large plants the especially developed industrial fire-fighting equipment manned with trained crews and the hospitals and first-aid stations staffed with trained physicians and nurses are much-copied models of efficiency. Some of these industrial installations are virtually self-sustaining and independent of protection assistance from the near-by community. Some of them lend protection equipment and manpower to the community.

But this self-protection is geared for peacetime. It is not organized to cope adequately with large-scale wartime disaster. In too many instances it is not even geared for peacetime disaster. An alarming number of industrial plants never recover and resume production after a devastating flood or fire.

Today our industrial installations are faced with the stark necessity of organizing self-protection adequate to deal with the atomic, biological, and chemical weapons of modern warfare. They must protect themselves against wartime disaster.

It has been established by military authorities concerned with national and international defense that in the event of another world war the enemy, armed with atomic weapons, will concentrate as never before upon the devastation of industrial facilities and the civilian workers who man them.

It has been established also that should the United States become embroiled in a war with Soviet Russia the latter has the means in weapons and transportation to deliver what under adverse conditions could be a knock-out blow to the industrial installations and workers in our critical target areas.

Imperative Need

Because there exists this possibility, whatever the likelihood, an adequate civil defense for industry is imperative. Our ability to wage a winning war rests largely on our industrial plants and their skilled workers. The productive capacity and the morale of these workers depend to a great extent on their safety and the safety of their families; that is, upon civil defense.

Some sixty-seven million persons live and work in our critical target areas. The Federal Civil Defense Administration's self-protection program for these areas covers industrial plants and extends also to: public utility companies and waterworks; hospitals, sanitariums, infirmaries, and mental institutions; schools, colleges, and universities; warehouses, lofts, and storage buildings; office buildings and department stores; hotels and large apartment houses; day nurseries, orphanages, and homes for the aged, veterans, and the blind; churches, convents, monasteries, and other religious buildings; theaters, museums, libraries, public buildings; and penal institutions.

Industrial Organization

In the individual industrial installation, Federal Civil Defense Administration (FCDA) planning conceives of wartime self-protection as the organizing and training of small groups within the industrial plant population to perform specialized services, such as rescue or fire fighting, to safeguard the plant and its occupants in time of disaster.

The constant and over-all objective is, of course, to keep up production when the installation is under threat of attack or when it is damaged in an attack and to resume production as soon as possible when it is damaged to the extent production must stop temporarily.

This "retooling" is not intended as

a wartime replacement for peacetime self-protection but rather as an augmentation of peacetime self-protection so that it is equipped to meet large-scale disaster more effectively. FCDA planning does not include security measures in regard to sabotage nor does this planning explore industrial dispersal beyond the sphere of safe storage of essential records, the sheltering of personnel, and in-plant dispersal of vital equipment and personnel, self-protection equipment and supplies, and new construction.

Need Varies

The need for civil-defense protection varies according to the size, purpose, and location of the industrial installation and its importance to defense production. But whatever the requirements, the underlying principles of self-protection remain the same. It is in order at this point, to emphasize the fact that the responsibility for planning and operating a self-protection program rests with management. The rôle of civil defense, be it Federal, State, or community is supplying guidance.

For the development of an effective self-protection organization within an industrial establishment, FCDA recommends some easily adaptable key steps:

Appoint Director

First, a director should be appointed with an appropriate title to indicate clearly that he is the defense coördinator of the installation. Obviously he must be an individual with ability to assume such responsibility, executive ability to get things done, and one in whom all plant personnel has confidence.

Secondly, the plant employees should be called in and their active coöperation sought. The importance of the in-plant civil-defense program to their personal safety, to the safety of the plant, to production, and to the safety of the Nation should be explained and the importance of individual coöperation emphasized.

The defense coördinator should be introduced and it should be made clear that he has the authority to speak for management and to take such steps for civil defense as he deems necessary, no matter how drastic they may seem.

Thirdly, coöperation should be sought at the outset with local civil-defense authorities. Their pooled information may provide invaluable guidance. Moreover, if the program for the industrial installation and its worker population is tied in with the community or area program, standardization of equipment will be possible and joint planning will insure effective warning dissemination and provision for mutual aid in an emergency.

Make a Survey

Fourthly, a survey should be made of buildings, sites, adjacent structures, and the like as a basis for locating and removing wartime hazards, indicating suitable shelter areas, and developing a program based on actual needs and utilization of existing facilities.

It is suggested that such a survey be made by technically qualified persons, such as representatives of casualty insurance underwriters, fire inspectors, or safety engineers. If the survey is made without technical guidance, the use of standard building report forms, such as may be secured from underwriters or building inspectors, should be used.

The plant defense coördinator, guided by the survey report, as an initial step should select and set up a suitable control center as a focal point of intelligence and command. Here all reports are received, requests for assistance evaluated, strategy determined, and orders issued. The control center should be linked to every area of the plant. The existing telephone system is usually adequate, but a messenger service should be organized for stand-by service if the system should fail.

Keep Lines Open

Arrangements should be made with the local telephone company for special lines to be kept open in an emergency so that the control center is in contact with neighboring plants and the local civil-defense organization. It should be located in a shelter area, as central as possible, and an alternate control center in another area should be prepared for use in case the regular center is put out of action. Equipment should include maps of the plant, a warning device, and all necessary communication equipment. The defense coördinator should go to the control center at the first warning of an emergency.

The immediate program of the coördinator is to plan his protection program, select his personnel, train them, and to drill the whole plant until the self-protection program works smoothly.

Personnel should be selected with care as the brunt of the protection program will fall on the disaster crews. Consideration should be given as to whether experience fits personnel to specific tasks and whether normal duties can be interrupted safely. Holding of key civil-defense positions outside the plant by plant personnel should be discouraged so as not to interfere with plant assignment. Deputy coördinators and assistants should be appointed as necessary to cover every shift.

Select Wardens

Wardens should be selected and appointed to the warden service under the immediate direction of the plant warden chief. Primarily concerned with safeguarding life and property, their major duty before an emergency is teaching; during an emergency, conducting people to safety; and after the emergency, restoring order. They must have a working knowledge of the whole self-protection program and be prepared to jump in and take hold wherever a snag develops. Wardens' equipment includes insignia, helmets, whistles, gloves, flashlights, first-aid kits, and gas masks.

It has now been established that Soviet Russia, in the event of war, has the means to deliver what could be a knockout blow to our critical industrial installations.

Plant police serve under direction of a plant police chief with the responsibility for maintaining order and discipline, safeguarding people and property, and directing traffic within the facility property. The number of police, like the number of wardens, depends on the size and complexity of the plant. Equipment includes insignia or uniforms, whistles, protective clothing for bad weather, and flashlights.

Health Services

The health services are under direction of a plant health director. This is an important job which may have to be done under difficulties because of the scarcity of professional people trained in the health fields. The health director is responsible for organizing and fitting out the first-aid and stretcher teams, and he must be prepared to handle casualties from both industrial hazards and atomic, biological, and chemical warfare. Fortunately, most plants have some health and first-aid facilities and a supply stock pile to serve as a starting point.

The plant engineering chief and his crews are concerned with maintenance and repair, demolition and clearance, decontamination, and rescue occasioned by demolition. Most of his crew members must be specialists or well trained in the preëmergency training program. Equipment includes the usual construction and demolition tools.

Welfare Director

The plant welfare director and his staff are concerned with emergency feeding, emergency transportation, registration and information, emergency financial assistance, and individual counseling. Some industrial welfare experience or preëmergency training is advisable. Existing industrial welfare or related services in the plant may well serve as a base of the welfare director's program. The matter of supplies and equipment is variable and should be worked out with the coördinator.

The plant fire chief is responsible with his highly specialized and trained crews for fire prevention, fire fighting, fire inspection, rescue from fires, and liaison with the local fire department. He has the advantage of the fact that most plants have fire-fighting equipment and trained personnel. He has the responsibility for training auxiliary firemen and for the strategic location of portable fire-fighting equipment.

The defense coördinator, his protective services set up, is ready to consider the matter of drills in alerts. This means he must have an adequate warning system. In many instances the existing public-address system can be used, but warning devices such as sirens or whistles may have to be installed, with proper precautions against power failure.

Shelters for personnel should be prepared and designated with the aid of the building survey report and technical experts. Some plants have existing areas which provide adequate shelter, some have areas which can be converted into good shelters, and some are faced with the necessity of preparing shelter structures.

European Experience

European experience in wartime bombing of industrial installations indicates that the type of suitable shelter depends among other things on the type of warning system employed, the time likely to be available between warning and evacuation, the evacuation plan, nature of existing buildings, nature of the subsoil water level, nature of the natural terrain, and the like.

Some European industrial plants report that shelters prepared in separate shelter structures away from the plant buildings were more satisfactory, but others prefer shelters in plant basements in existing buildings. Worker opinions are divided, but labor and management are agreed that shelters are necessary for morale and for actual safety.

There is no substitute for drill under simulated emergency conditions in perfecting the plant protection program. Burrs, snags, and initial confusion will usually develop. After a drill or two, most of these will smooth out. Everybody will begin to know what he is supposed to do and will do it.

The defense coördinator, his drills under way and his program organized, can take stock and ask himself such questions as:

Questions

Have all possible hazards been removed?

Have I appointed some one with the sole responsibility to see that essential records are safely dispersed and stored? Has this person prepared a plan or stored the records?

Am I prepared to deal with dangerous radiation detection after an atomic-bomb burst?

Have I arranged for mutual aid with neighboring plants and the local civil-defense organization?

Have I arranged the most effective evacuation plan?

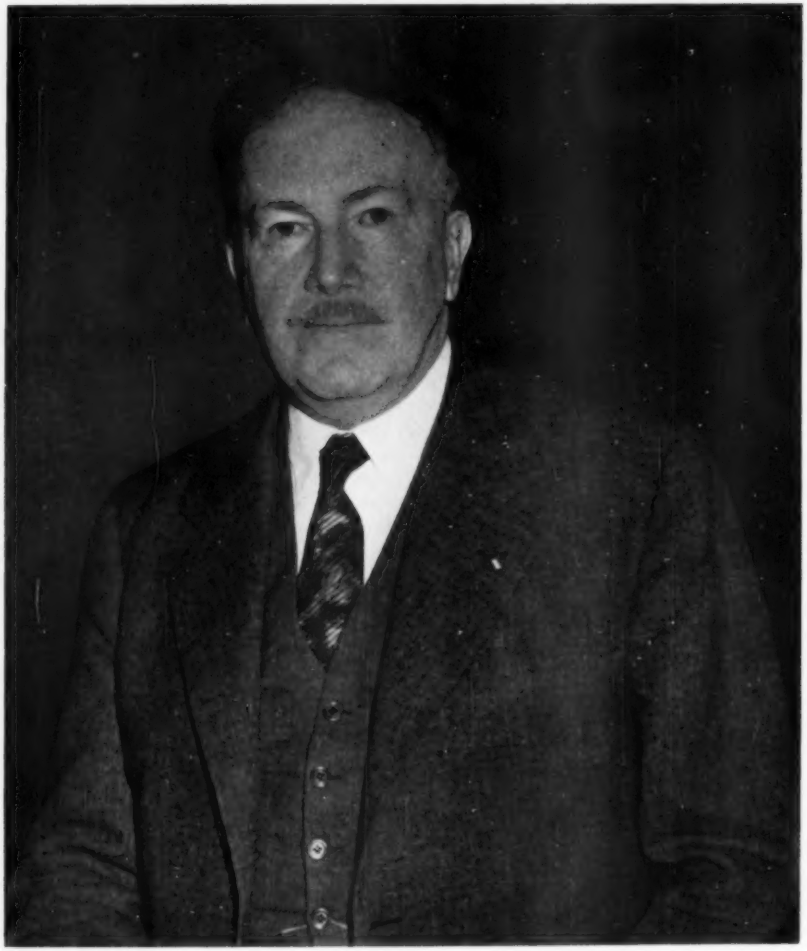
Have I conferred with my protective services chiefs to see if they have made the best utilization of existing equipment?

And, finally, has management taken adequate steps to insure continuity of management through actual physical dispersal of officials and rotation of duties; has management taken adequate steps to insure continuity of production by preparations to assume supply, distribution, and transportation services ordinarily performed by nonplant facilities which may be crippled or destroyed in an emergency?

With these and related questions answered satisfactorily and the whole plant self-protection-minded, the defense coördinator with a determination not to relax vigilance, can find satisfaction in the knowledge that the best way to cope with disaster is to be thoroughly prepared to meet it.

Technical Booklet

The Federal Civil Defense Administration has prepared a technical booklet, "Civil Defense in Industry and Institutions," specifically for use in organizing and administering a civil-defense self-protection program for the Nation's industrial plants and other institutions. It is available through your local or State Civil Defense organization, or through the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C.



JAMES LAWRENCE WALSH

Born May 6, 1885 • Died June 11, 1952

THE American Ordnance Association announces with profound sorrow the death of its distinguished president, Colonel James L. Walsh, at Washington, District of Columbia, on June 11, 1952.

He Worked for Peace

THE dominant theme throughout the life and work of Colonel Walsh was often expressed in his own words, "Working for Peace." This spirit characterized his zeal when he helped to organize the Ordnance Association in 1919. When, in the following year, he established the Association's journal, then called ARMY ORDNANCE, and until his death, June 11, 1952, in Washington, D. C., the same ideal inspired him, especially as president of the Association—an office he filled with distinction since 1947.

A native of Boston, Mass., Colonel Walsh was graduated from the United States Military Academy in 1909. He served in the Ordnance Department of the Army during the First World War as assistant to Maj. Gen. William Crozier and later as assistant to Maj. Gen. C. C. Williams. Under their tutelage he became first secretary of the Army Ordnance Association and first editor of this journal.

When he retired from active military service in 1923 to join the Bankers Trust Company, New York, he became a member of the Association's Board of Directors, serving in this capacity until his death. Following his retirement from banking and industry in 1947 he was elected to the presidency of the Association which he had helped to found. In this capacity he gave voluntarily and unstintingly of his talents to the progress of our national defense.

He served as chief of the New York Ordnance District from 1923 to 1932; as chairman of the Production Committee, American Society of Mechanical Engineers, 1939 to 1945; and as vice-chairman of the National Technological Advisory Commission, 1940 to 1946.

He was awarded the Distinguished Service Medal for his service in the First World War. In 1941 he was awarded the Ordnance Association's Crozier Gold Medal for outstanding service to the cause of industrial preparedness.

Jovial, kindly, brilliant of mind, and ceaseless in energy, Colonel Walsh was known and admired throughout the entire Ordnance fraternity. His wide acquaintance among the military services—Army, Navy, and Air—and his countless friendships in science and industry endeared him to all his associates among whom the great worth of his patriotic contribution to the security of our country will remain an inspiration. The Ordnance Association which he served so long and so well mourns with a deep sense of loss the passing away of its president.

To members of his family the Association offers heartfelt condolences. To all at National Headquarters of the Association, who through the years held him in sincere affection, his example ever will be a guiding light. In truth he worked fervently for the Ordnance Association's ideals—to keep America strong for peace—peace for our country and for all mankind.

Month by Month: Highlights of the National Defense

Floberg on Carriers

"Time is standing still for us if we do not keep a steady flow of modern equipment into the fleet."

Addressing a Navy League luncheon in Washington, John F. Floberg, Assistant Secretary of the Navy for Air, called for big aircraft carriers of the FORRESTAL class as necessary for the accomplishment of our Navy's primary mission. While favoring the principle of economy in government, he expressed his belief that first things come first.

> *"I fail to see," he said, "how we as a nation can logically undertake a program of investing billions of dollars in overseas bases and overseas-based forces and then hesitate to invest a relatively small fraction of those billions in the instruments most essential for making those bases tenable and those forces supportable."*

Mr. Floberg expressed the view that ten FORRESTAL-class carriers are urgently needed, and he doubted whether the Nation could afford to build them at as slow a rate as one a year.

"What the decision must be," he declared, "is just as inexorable as the fact that control of the sea has always been inseparably dependent upon the mounting of the weapon of the day on a ship. This principle has persisted through the eras of the ramming prow, the sword, the musket, the smoothbore cannon, the large-caliber naval rifle, and the propeller-driven aircraft.

"Now we are at the point of not merely the jet aircraft but of an increasingly higher performance jet aircraft, and the fact is absolutely certain that whoever controls the air over the sea is going to control the sea itself.

"The question is not one of a 'supercarrier,' a term which I abhor," he continued, "but simply a recognition of the fact that in the second half of the twentieth century the orderly development of our Nation's capability for defense depends on its ability to operate the most modern aircraft on a ship as close as is necessary to the enemy's shore line to permit the Navy to perform its primary mission.

"The Navy must be able to put into the air such aircraft as are necessary to insure that no enemy plane, surface ship, or submarine can threaten to drive our shipping from the seas and at the same time such aircraft as can, together with other naval forces, drive enemy shipping from the seas regardless of the equipment which the enemy uses to defend it."

> *Mr. Floberg cited the fact that a modern jet fighter on the catapult is loaded with from fifteen to thirty barrels of fuel and that her fuel-loaded wing-tip tanks weigh half a ton apiece.*

One of our carrier-based jet fighters has more weight in its fuel alone than the total empty weight of the F_4F with which we started the war, and either of these fighters carries more weight in fuel and armament alone than the empty weight of any of the torpedo planes or dive bombers with which we started the war.

The evolution of aircraft types throws great demands on carriers. The Nation needs, and should have, new, up-to-the-minute, big carriers.

Idle Machine Tools

Authority to allocate all idle military-owned machine tools, as well as other idle production equipment, and to maintain the central inventory of such equipment has been transferred by the Department of Defense to the National Production Authority, Department of Commerce, it was announced recently by Henry H. Fowler, NPA Administrator, and J. D. Small, Chairman of the Munitions Board.

Commenting on the action, Mr. Small said that "this transfer of authority to the National Production Authority, so as to enable that administration to specify the ultimate use of idle military-owned equipment, will, in my opinion, be an important step toward relieving the production difficulties which our contractors are now experiencing."

> *The Production Equipment Central Inventory Group was established by the Munitions Board in 1951 as a central location where the departmental reserve machine-tool inventories were maintained.*

The purpose in establishing the group was to provide a central location for defense contractors for a quick determination of whether needed machine tools were available from Army, Navy, or Air Force storage before applying for the procurement of new tools.

The scope of the Central Inventory Group has been expanded until, at the present time, it is required that all military-owned idle production equipment be listed with this group.

There remain in the inventory several thousand semispecial types which are capable of performing many of the operations required by military contractors and defense-supporting industries.

Mountain to Mohammed

A mobile ordnance exhibit, designed by the Navy Bureau of Ordnance to stimulate small-business interest in the manufacturing of ordnance equipment, is now on a nationwide tour.

> *Each of the 48 States will be visited during the 14,000-mile trip. All cities of over 400,000 population will have an opportunity to view the unique exhibit.*

Officers and members of the various Posts and Chapters of the American Ordnance Association have offered their coöperation in furthering the purposes for which the tour and exhibit are designed.

Our Army after 177 Years

An Editorial

ON June 14, 1952, the United States Army marked its 177th birthday. The Nation can take pride in two facts about this anniversary: (1) Our Army is the *oldest* of our armed forces, and (2) our Army is the *only* element of the armed forces that has existed continuously on an active status from the Revolutionary War to the present day. (Sad to relate, our Navy and Marine Corps, established in November and December of 1775, were disbanded following the Revolutionary War and reëstablished several years later.) Since its founding on June 14, 1775, there has always been a United States Army.

The national and world picture today is very drab, indeed. There are many disappointments, frustrations, and failures associated with our national-defense program. The exasperating stalemate in Korea and Soviet Russia's angry efforts to sabotage free-world unity have brought about a situation fraught with uneasiness and foreboding.

Reasons for Confidence

Yet there are many solid reasons for hope and confidence. Our Nation has experienced many dark hours before—and triumphed over them. In an era of change and uncertainty, it will do all of us good to review briefly our Army's long and distinguished record of service to the cause of American freedom.

Our Army was established in 1775. This was a whole year *before* the most famous date in American history—July 4, 1776, when the Continental Congress declared our independence of British rule. Our armed forces were formed, in other words, before we became a free nation. Our Army is actually older than the United States itself.

On June 14, 1775, after much debate, the Congress voted to establish ten rifle companies "to join the Army near Boston, to be there employed as light infantry, under the command of the chief officer of that Army." It was specified that six of these companies would come from Pennsylvania, two from Maryland, and two from Virginia.

The next day, June 15th, George Washington was named Commander in Chief of the newly formed Continental Army. A week later he set out for Boston. On July 3, 1775, he took command of his new Army, composed partly of the new regulars and partly of militia units.

From that day to this, our Army has varied greatly in size—valor being the only surviving constant. In times of great national peril our Army has suddenly mushroomed to as many as eight million. In times of great public lassitude (usually in periods following victory) our Army has just as quickly been permitted to shrivel in size to less than one modern company of soldiers!

The public has a short memory. Lacking historical perspective, it is fickle. Thus the pendulum of popular interest in the national defense has swung from feast to famine, from formidable strength to supine weakness, from thousands of big battalions to none at all. If you think this an exaggeration, compare our Army of eight million in 1945 with our Army in 1947—twenty-one months later—of one million.

An even more shocking example of shortsightedness occurred in the Colonial era. Our Continental Army achieved a maximum strength of 35,000. Soon after the defeat of Cornwallis at Yorktown in 1781 and Great Britian's recognition of the independence of the Colonies, the Continental Congress disbanded most of the Army, authorizing only a force of eighty men—"twenty-five to guard the stores at Fort Pitt and fifty-five to guard the stores at West Point."

These eighty men are important in our Army's history. Without them we could not say that our Army has served without a break since 1775. Some of these men belonged to a unit that still exists today. This was the company raised by Alexander Hamilton which was retained after the Revolution as a Regular Army unit. That unit today is Battery D, 5th Field Artillery Battalion, now serving in Europe as part of the 1st Infantry Division.

Following the Colonial era there began a long record of campaigns and wars, some of them merely police actions (in fact!), others gigantic world wars. It is an awesome and inspiring chronicle from "the shot heard around the world" in 1775 to the savage and costly war in Korea in 1952.

Not until the current conflict in Korea has our Army ever been required to fight for a stalemate and not for victory. Stalemate was not the objective of the long unbroken line of brave men whose service and sacrifice are brought to mind by Valley Forge and Yorktown, New Orleans, the Valley of Mexico, Gettysburg, San Juan Hill, the Marne and Chateau-Thierry, Bataan and Corregidor, Oran and Casablanca, Salerno and Anzio, Utah and Omaha Beaches, Leyte and Luzon, the Ardennes Forest, and Okinawa.

The Cost in Lives

Our costliest war in human lives, the American Civil War, on the Union side alone took a death toll of about 53,000 men greater than World War II deaths in our Army and Air Force. Army casualties alone in Korea to date number more than 88,000. Of this number, nearly 15,000 have made the supreme sacrifice. It is difficult to champion a stalemate policy at such a heavy cost in human lives.

Our Army today is still top-heavy in organization and still wasteful of manpower. "Career management" and other new devices are costly in time and money.

The history of the past 177 years is a glorious one, indeed, the dominant notes of which are integrity, frugality, thrift, discipline, and perseverance. These noble virtues have characterized our Army during its long history. They will be the Army's—and the Nation's—salvation in the future.

ASSOCIATION AFFAIRS

• **AT WASHINGTON.**—The Association's Executive Committee met at the Metropolitan Club in Washington, on May 13, 1952, for the consideration of policies and programs in the interval between meetings of the Board of Directors. This meeting of the committee came to a happy climax when the members journeyed to the United States Naval Academy at Annapolis on May 14th for a most instructive and enjoyable visit as the guests of the Superintendent of the Academy, Vice Adm. Harry W. Hill.

Present at the Executive Committee Meeting were President James L. Walsh, Washington, D. C., who presided; Col. Herbert A. Gidney, Hyannis Port, Mass.; Louis Polk, Dayton, Ohio; and Robert L. Biggers, Detroit, vice-presidents.

Also present were Henry N. Marsh, general chairman of the Association's Technical Divisions and Committees; Brig. Gen. Burton O. Lewis, staff consultant; Roger E. Lewis, managing editor; and, by special invitation, Walter N. Howley, chairman of the Shell Committee of the A.O.A. Rocket, Bomb and Artillery Ammunition Division. Leo A. Codd, executive vice-president of the Association, served as secretary of the meeting.

Reports were received from the president, the treasurer, the counsel, the managing editor, the executive vice-president, and the staff consultant for Technical Divisions and Committees outlining the operations for the preceding four months and the present status of operations in the respective fields.

The president reported that plans had been carried to successful conclusion for participation by the Association in the sesquicentennial observance of the United States Military Academy at West Point. This participation included a series of lectures on ordnance topics, under the sponsorship of the Association, to members of the First Class at the Military Academy during the week of April 21, 1952.

Mr. Polk presided at a seminar incident to the program and at the dinner meeting which followed. The special events were planned to show the importance of superior ordnance in modern warfare and to impress the cadets with the great interest taken by American industry in the equipment of our armed forces and the vital rôle of industry in supplying this superior ordnance on time and in the quantities required.

In recognition of outstanding service to the Ordnance Association in recent months the Executive Committee voted unanimously to confer honorary life memberships in the Association upon the following:

Maj. Gen. F. A. Irving, Superintendent, United States Military Academy, West Point, New York; Vice Adm. Harry W. Hill, Superintendent, United States Naval Academy, Annapolis, Md.; and Lieut. Gen. Edwin W. Rawlings, Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio.

In the evening, following the Executive Committee meeting, Colonel Walsh presided at a dinner and seminar at which the following directors of the Association were in attendance: K. T. Keller, chairman, Chrysler Corporation, Detroit, Mich.; Charles D. Wiman, president, Deere & Company, Moline, Ill.; Lieut. Gen. Levin H. Campbell, director, Curtiss-Wright Corporation, Paterson, N. J.; Adm. W. H. P. Blandy, president, Health Information Foundation, Inc., New York, N. Y.; and Maj. C. Stewart Comeaux, executive secretary-treasurer, Institute of Makers of Explosives, New York, N. Y.

Hon. John F. Floberg, Assistant Secretary of the Navy, was the guest of honor. Council of the Association was represented by Maj. Gen. James H. Burns, former Assistant Secretary of Defense. James D. Maitland, president, Rocky Mountain Post, Denver, Colo., and Maj. Gen. R. L. Maxwell, a director of the New York Post, were in the distinguished company which also included among others Maj. Gen. E. L. Ford, Chief of Ordnance of the Army; Rear Adm. W. S. Parsons, Assistant Chief, Bureau of Ordnance, U. S. Navy; Brig. Gen. Edward P. Mechling, Chief of the Armament Test Center, U. S. Air Force, Eglin Air Force Base, Fla.; and Capt. Leonard F. Freiburghouse, professor of ordnance and gunnery, U. S. Naval Academy, Annapolis, Md.

The visit to the Naval Academy the following day was through the good offices of Adm. W. H. P. Blandy, a director of the Association, who led the A.O.A. delegation to Annapolis. The committee was met by Admiral Hill and under his direction visited the various departments of the Academy. Members had luncheon with the Brigade of Midshipmen and also were privileged to attend a dress parade and review in the afternoon.

The excellence of the training, educational system, and facilities of the Naval Academy was apparent on all sides and the *esprit* was most impressive. Throughout the entire visit there was constant evidence of the scholarship and tradition which have made our Navy an outstanding historic example of naval strength and leadership.

• **AT WEST POINT.**—The Gage Industry Division of the Association held its annual meeting at the United States Military Academy, West Point, N. Y., on April 25, 1952.

The Academy is this year celebrating the sesquicentennial anniversary of its foundation. On March 16, 1802, President Thomas Jefferson approved an act of Congress creating the Academy. West Point has been continuously garrisoned by United States troops since 1778.

The invitation to visit the Academy was extended by Maj. Gen. Frederick A. Irving, Academy Superintendent.

"It is always a pleasure to welcome representatives of the American Ordnance Association to West Point," General Irving wrote the Association. "At this time I am particularly pleased to extend cordial greetings to the Gage Industry Division of this patriotic organization.

"Your meeting at the Military Academy visibly demonstrates to the cadets your unselfish interest in national defense. I am certain that your presence here will contribute toward broadening their knowledge of industry's vital influence upon their profession.

"I hope that during your visit you will have an opportunity to become better acquainted with the traditions and objectives of this historic place."

Members of the Gage Industry Division were cordially received at the Academy by Col. John D. Billingsley, professor of ordnance, and the afternoon meeting was held in the lecture room of the Ordnance Laboratory on the West Point campus.

General Barnes receives John C. Jones Medal at Philadelphia Post Meeting.

Left to right: Mrs. John C. Jones, after whose late husband the medal was named; Gen. Jacob L. Devers, former commanding general, Army Ground Forces; Brig. Gen. D. N. Hauseman, Post president; Maj. Gen. G. M. Barnes, vice-president, the Budd Company; and W. H. Worrilow, Sr., president of Lebanon Steel Foundry, host to the A.O.A. members at the Philadelphia Post meeting

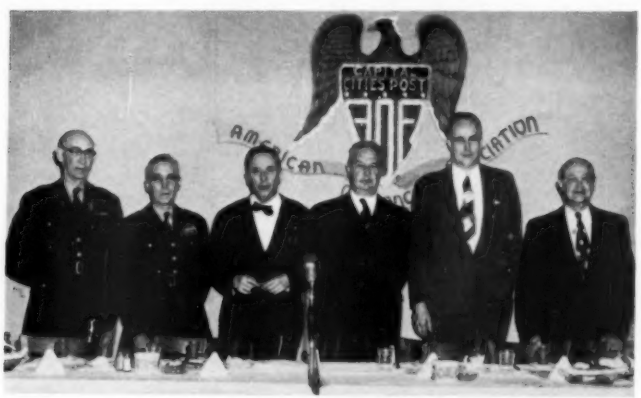
Louis Polk, chairman of the A.O.A. Gage Industry Division and president of the Sheffield Corporation, Dayton, Ohio, made the opening remarks and introduced the distinguished guests.

Six talks were given. Modern gaging practice was outlined by James Wilkie, gage engineer of the Pratt & Whitney Division of Niles-Bement-Pond Company, West Hartford, Conn. Multiple inspection was discussed by W. Fay Aller, director of research of the Sheffield Corporation, Dayton, Ohio. Glen Stimson, sales manager and chief engineer of the gage division of the Greenfield Tap and Die Company, Greenfield, Mass., spoke on the subject of fixed gages.

Col. J. G. Schneider, deputy chief of the Quality Control Division of the Air Matériel Command, Wright-Patterson Air Force Base, Ohio, chose gaging and quality control as his topic.

Concluding addresses were given by Lieut. Comdr. W. Dubyk, gage officer at the U. S. Naval Gun Factory, Washington, D. C., who concentrated his remarks on interchangeability control for multi-source subassemblies, and by Lieut. Col. William H. Sloan of the gage laboratory at Frankford Arsenal, Philadelphia, Pa., who presented an estimate of the gage industry's productive capacity.

General Irving and his staff joined with Association members in sending a telegram to James L. Walsh, Association president, to express cordial greetings and to thank him for his great contribution to the success of the meeting.



Second Annual Meeting of the Capital Cities Post, Lathams, N. Y.

Left to right: Col. Harry N. Rising, commanding Watervliet Arsenal; Maj. Gen. E. E. MacMorland, commanding Aberdeen Proving Ground; Harry L. Erlicher, Special Assistant to the Under Secretary of the Army; Ledyard Cogswell, Albany Lumber and Planing Mill Company; Rufus Easton, Allegheny Ludlum Steel Company; and Edward S. Webster, Watervliet Arsenal.

• **DR. A. V. ASTIN,** Government career scientist, proximity-fuze expert, and Association member, was nominated by the President in May to be director of the National Bureau of Standards. Dr. Astin has been acting chief of the Bureau since October 1951, shortly after the resignation of Dr. Edward U. Condon.

Dr. Astin is especially distinguished for his invaluable contribution to the development of the proximity fuze. Upon joining the Bureau of Standards in 1932 he was assigned to research in electronic problems in heat and power.

He formerly worked in the Bureau for the Utilities Research Commission, Inc., of Illinois. His special study was in the electronic problems of public utilities.

From 1932 to 1940 Dr. Astin was active in electronic research and did pioneer work in radio telemeter techniques for exploring the earth's upper atmosphere.

In 1940 he was assigned to the newly formed proximity-fuze research group in the Bureau and took a leading part in the development of the fuze.

The proximity fuze is essentially a tiny radio device attached to a bomb, rocket, mortar shell, or guided missile that causes detonation when it comes within maximum damage range. It was successfully demonstrated in February 1941.

In 1944 and 1945 Dr. Astin was assigned to the European Theater of Operations as a representative of the Bureau and of a division of the National Defense Research Committee.

After his return from Europe, Dr. Astin became assistant director of the Bureau's ordnance department. In 1947 he became chief of that division. Three years later he was appointed associate director of the Bureau. He had charge of ordnance and missile development, and coördinated the Bureau's technical work with other Government agencies.

• **DR. LOUIS THOMPSON.**—The Navy's Distinguished Civilian Service Award has been presented to Dr. Louis Ten Eyck Thompson of White Plains, N. Y., for his achievement in the field of naval ordnance.

Dr. Thompson, former technical director of the Naval Ordnance Test Center, Inyokern, Calif., received the award from Secretary of the Navy Dan A. Kimball at a ceremony in his office.

Now a consultant to the president of Norden Laboratories in White Plains, Dr. Thompson retired from government service last October. He was associated with the Inyokern test station from its establishment in 1945.

The citation accompanying the award reviewed the achievements of the ordnance station under Dr. Thompson's directorship and called attention to advances made in the fields of aviation

ordnance and jet-propelled weapons.

Dr. Thompson continues as a member of the Inyokern Advisory Board. He is also a member of the Scientific Advisory Board of the U. S. Air Force and is in the advisory group for the Air Weapons Center.

• **HUSTON G. WELCH**, a resident of Brazil, Ind., and transmission service representative for the Allison Division of General Motors, was awarded the Bronze Star Medal—highest military citation awarded to a civilian—for "invaluable assistance above and beyond his normal responsibilities" while serving as a civilian technician with the ground forces in Korea.

The presentation was made by Col. N. C. Pilet, chief of staff of VI Corps at Camp Atterbury in the presence of Allison officials in the office of E. B. Newill, general manager. Mr. Welch was assigned as a field-service representative to accompany the first shipment of General Patton M46 tanks dispatched to Korea in July 1950.

His job was to instruct and assist in the maintenance of the Allison CD-850 transmission in the M46 tank. According to the citation, "he accompanied the 6th Medium Tank Battalion in action, participating in many of its difficult combat operations, constantly being on the alert for mechanical difficulties. He tenaciously remained with the unit, frequently fiercely engaged with the enemy. On two occasions Mr. Welch received wounds from enemy action while in forward areas under intensive hostile mortar and small-arms fire."

According to Allison officials, the citation referred principally to Mr. Welch's action in retrieving four General Patton tanks which were disabled at a time when ground forces withdrew from an advanced position. Staying behind to supervise repair of the tanks after all troops had been evacuated, Mr. Welch finished his work under sniper fire.

Headlights on the tanks had been shot out so the drivers followed Mr. Welch to safety by the lights on his jeep. A soldier riding with Mr. Welch was killed, and he himself was wounded in the ride down narrow mountain passes.

• **COL. DALE C. HALL** of Washington, D. C., a charter member of the American Ordnance Association, died at Strong Memorial Hospital, Rochester, N. Y., May 20, 1952. He was one of our country's outstanding experts on powder and explosives, having devoted a major portion of his thirty-two years of active military service in the Ordnance Department of the Army to operations in those fields.

Colonel Hall served in the Ammunition Division, Office of the Chief of Ordnance, during several tours of duty in Washington. In addition he filled important assignments at the Picatinny Arsenal, at Aberdeen Proving Ground, in Hawaii, at San Antonio, and San Francisco.

During World War II he took a prominent part in the mobilization for the production of artillery ammunition in the Office of the Chief of Ordnance, following which he led military missions to Africa and Italy. Later he served with the safety and security Ordnance organization at Chicago. His last assignment was with the Armed Services Explosives Safety Board. Unassuming yet brilliant, Colonel Hall did much to improve the design and production techniques of artillery ammunition for our armed forces.

He was one of that small band of Regular Ordnance officers whose allegiance to technical excellence in their profession contributed to make the Ordnance Department an outstanding component of our Army. They kept the Ordnance flame burning brightly when public funds were scarce and when popular approval was meager. To have shared in this responsibility, as Colonel Hall did, was recompense enough.—L.A.C.

• **JAMES C. KARNES**, ordnance engineer who was a top authority on artillery fire-control techniques and mechanisms, died of a heart attack while leaving his Pentagon office in Washington on April 30th.

Mr. Karnes had been with Army Ordnance for thirty-seven years and had been granted fifty-three patents for ordnance inventions. He was noted among his many friends for his great industry, ability, kindliness, humility, and good fellowship. He was a charter member of the Ordnance Association among the members of which he had wide acquaintanceship.

Like Colonel Hall (above) with whom he was associated in the Ordnance office for many years, Mr. Karnes attained wide recognition as a specialist in his field and remained in Government service when his talents could easily have brought him substantial recompense in private industry. Loyalty was a cardinal note of Jimmy Karnes' life and work. —L.A.C.

• **JOHN S. SHAW**, former director of safety of Hercules Powder Company, died April 26th in Houston, Tex. He retired in 1950 after nearly half a century of pioneering in the field of industrial safety.

Mr. Shaw was a member of the Safety and Security Division of Army Ordnance in the Second World War, serving as a consultant to the chief of that division, and was a former director of both the National and Delaware Safety Councils, and a member of the Safety Engineers' Club of Delaware.

• **IRVIN S. REITER**, manufacturing specialist of the Bethlehem Steel Company, died on April 24th. A graduate of Lehigh University, Mr. Reiter had been with Bethlehem since 1915 and held a number of positions in the manufacturing division which includes all forges, foundries, and machine shops.

• **PATRICK JOSEPH RYAN**, research

Col. Henry E. Minton, left, receives A.O.A. charter for the newly formed El Paso (Texas) Chapter from Maj. R. D. Campbell, representing the Lone Star Post.

Newsmen tell Lansing Chapter members of 17,000-mile ordnance inspection tour.

Left to right: Stanley Brams, McGraw-Hill Publications; Lieut. Col. Thomas A. Rice, public-relations officer, Detroit Ordnance District; Leonard Westrate, Chilton Publications; J. F. Wolfram, vice-president, G.M.C.; Leo A. Codd, executive vice-president, A.O.A.; Norman Nicholson, United Press; John Leonard, *Newsweek*; and L. F. Carlson, president, Lansing Chapter, Michigan Post.

engineer and assistant to the chief of the Industrial Division of the Boston Ordnance District, died at his home in Quincy, Mass., on March 1, 1952. Mr. Ryan had a long and distinguished career as an engineer with various concerns in New England and with Army Ordnance.

During World War I he served as a major at Watertown Arsenal. At the outbreak of World War II he became chief gage engineer of the Boston Ordnance District and remained with the district until his death. He was awarded a Meritorious Civilian Service Certificate and Emblem by the Chief of Ordnance in 1945.

• **C. LAURENCE WARWICK**, executive secretary of the American Society for Testing Materials, and its administrative head since 1919, died on April 23, 1952, shortly after presiding at a dinner honoring the retiring treasurer of the society.

Mr. Warwick made many notable contributions to the field of standardization and research in materials, and was recognized as an outstanding authority on materials. One of his important contributions was in the War Production Board during World War II where he served as head of the Specifications Branch of the Conservation Division and later headed the Materials Division.

• **AT LEBANON.**—Three hundred and fifty enthusiastic members of the Philadelphia Post journeyed by special trains from Philadelphia to take part in a unique and highly mobile meeting that began with a visit to the Lebanon Steel Foundry at Lebanon, Pa., moved on to the Indiantown Gap Military Reservation, and concluded with a dinner at the Hotel Hershey, Hershey, Pa.

All this took place on May 15, 1952. Messrs. Worrilow, father and son, marshaled the group with precision throughout the day. At the plant, members and guests were conducted through one of the outstanding steel foundries the world over. Lebanon's contribution to Ordnance progress is of the highest order!

Following the plant visitation, Post members observed training at the Indiantown Gap Military Reservation and had lunch on the reservation. John S. Fine, Governor of Pennsylvania, was the honor guest. Early in the afternoon, Brig. Gen. D. N. Hauseman, Post president, presided at a business meeting on the reservation.

Welcoming remarks were made by Maj. Gen. L. B. Keiser, commanding general of the 5th Infantry Division and host of the occasion. Lieut. Gen. E. H. Brooks, Commanding General of the Second Army based at Fort George G. Meade, Md., addressed the meeting and introduced the guest speaker, Gen. Jacob L. Devers, world-famed American commander in Europe during the Second World War, former Chief of Army Field Forces, and now technical assistant to the president of the Fairchild Engine & Airplane Corporation. General Devers thrilled his hearers by his analysis of ordnance strength now being developed and recounted many instances in the European battles of the superiority of our weapons.

Before leaving the reservation, Post members had the privilege of reviewing the 12,000 members of the 5th Infantry Division on Muir Field.

Late in the afternoon more than 400 A.O.A. members assembled for dinner in the Hotel Hershey. The invocation was given by Col. John K. Connelly, post chaplain of the Indiantown Gap Military Reservation. The master of ceremonies was General Hauseman, and the principal address was given by W. H. Worrilow, Sr., president of Lebanon Steel Foundry.

The principal feature of the dinner was the presentation by General Hauseman to Maj. Gen. G. M. Barnes of the John C. Jones Medal for distinguished service to Ordnance. The medal is awarded annually for exceptionally meritorious service to Ordnance. General Barnes, well-known for his ability as an executive and engineer, was chief of research and development for Army Ordnance throughout the Second World War. Until his affiliation with the Budd Company in 1946 his long record as an officer of the Ordnance Department, U. S. Army, added luster to Ordnance progress during more than thirty years.

Distinguished guests during the day included Capt. R. L. Adams, R. W. Brown, Lieut. Gen. E. H. Brooks, Comdr. Clarence Cisin, Leo A. Codd, Brig. Gen. Robert E. Condon, Richard B. Cooney, Maj. Gen. Merritt A. Edson, Harry L. Erlicher, Col. William K. Ghormley, Maj. Gen. L. B. Keiser, R. T. Keller, Col. Roy C. Heflebower, Dr. Frederick K. Miller, E. C. Rose, Jr., Lieut. Gen. Frank A. Weber, and Mrs. John C. Jones.

The Activities Committee comprised Chairman Albert W. Gilmer, General Barnes, Lieut. Col. James A. Crewe, George P. Luckey, Mr. Worrilow, and W. H. Worrilow, Jr.

The Honorary Medals Committee consisted of Chairman Henry W. Gadsden, Col. Ward E. Becker, Colonel Ghormley, and Everett B. Webster.

• **AT NEW YORK.**—The April meeting of the New York Post at the Hotel Astor featured an address by Rear Adm. Roscoe H. Hillenkoetter on the Korean situation. He was exceptionally well qualified from his command experiences in the heaviest of Korean fighting to give Post members and their friends facts straight from the shoulder.

Prior to his Korean experiences, Admiral Hillenkoetter served four years as the first Director of the Central Intelligence Agency in Washington. Today he is commander of the Naval Base in New York.

Two films were shown. The first portrayed the heroic retreat of the Marines from Chosin to Hungnam in the early days of the Korean war. The film dramatically showed the heartbreaking effect of war on the civilian population as well as the way the Army and Marines take on a personal fight. The second film told the 1952 story of aircraft armament and emphasized the important work being carried on by the Ordnance Association in coöperation with the U. S. Air Force.

The Meeting and Program Committee, responsible for the attractive program, consisted of Chairman H. T. Luria, T. F.

Brown, C. Stewart Comeaux, J. M. Gruitch, P. B. Scott, and Vice Adm. George F. Hussey, Jr.

The biannual election of Post officers and directors was held following the president's report and the presentation of the Nominating Committee's report by Chairman Crosby Field.

Admiral Hussey was reelected president. The four vice-presidents are J. L. Auer, Mr. Luria, Maj. Gen. R. L. Maxwell, and John G. Phillips. The secretary-treasurer is Col. John S. Walker.

The new board of directors includes George W. Allison, Follett Bradley, Mr. Brown, Paul T. Cullen, William Eisner, C. L. Farrand, William R. Janney, D. B. MacMaster, Chester Mueller, Herman A. Peterson, Henry N. Sachs, L. W. Stearns, A. E. Van Cleve, P. R. Bassett, Major Comeaux, Mr. Field, Mr. Gruitch, and L. C. Stowell.

• **AT LATHAMS.**—The Capital Cities Post held its annual dinner meeting on May 12th in the Loudon Room, Crossroads, Lathams, N. Y.

Presiding at the meeting was Post President Harry L. Erlicher, Special Assistant to the Under Secretary of the Army. The guest speaker was Maj. Gen. E. E. MacMorland, commanding general, Aberdeen Proving Ground, Md.

In his opening remarks Mr. Erlicher mentioned the effect that the current rearmament program is having on industry and paid tribute to the role being played by industry in the Troy-Schenectady-Albany area.

General MacMorland spoke on "Aberdeen—Where Peace Power Is in the Making." He outlined the great variety of operations being performed at Aberdeen and other proving grounds in connection with the development of new weapons and the testing of ordnance material. Items run from the smallest pistols to massive tanks; all types of cannon; highly technical fire-control equipment; and many other complicated machines of modern warfare.

Training programs, General MacMorland emphasized, are being conducted to develop skilled personnel to meet the demands for the maintenance and operation of today's complex military equipment. General MacMorland also called attention to the great expense involved in connection with this equipment and the terrific rise in costs during the past few years. He cited the example of a truck that cost $2,800 during World War II that now costs approximately $7,000.

He described the cost-consciousness training program that is being conducted to make Army personnel realize their responsibility for expensive equipment.

John O. Amstuz, chairman of the Post's Committee on Industrial Preparedness, reported on the aid that has been rendered to small business in the area in connection with defense production work.

E. E. Johnson, chairman of the Post's Committee for the Advancement of Technical Education, reported on the activities that are being carried on to combat the existing serious shortage of technically trained personnel. Educators and students have been publicly informed that industry has many opportunities and offers its combined services to young people.

Prior to the dinner meeting the board of directors met in Col. Harry N. Rising's quarters at Watervliet Arsenal where officers were elected for the coming season.

Mr. Johnson, general manager of the General Engineering Laboratory of the General Electric Company, Schenectady, was elected president to succeed Mr. Erlicher. John E. H. Hume, Sr., and Rufus Easton were named vice-presidents.

The new directors, elected for 3-year terms, are Mr. Amstuz, Mr. Easton, Adm. W. A. Kitts, Mr. Erlicher, Hiland G. Batcheller, Chester H. Land, Albert H. Maggs, Brig. Gen. Wendell H. Westover, Ledyard Cogswell, Colonel Rising, Mr. Johnson, and Leon W. Dwyer.

A few weeks prior to the meeting the Post sponsored a visit to Watervliet Arsenal of a group of 350 high-school students of the Albany-Troy-Schenectady area to correct the erroneous idea that the engineering field is overcrowded. During a tour of the arsenal, Colonel DeGuire, M. Kerin, E. S. Webster, and Mr. Maggs illustrated the number of jobs available in a manufacturing operation.

Colonel Rising, commanding officer of the arsenal, officially welcomed the visitors. Two brief talks, pertinent to the operation witnessed, were made by Prof. A. A. K. Booth of Rensselaer Polytechnic Institute and J. L. Michaelson, manager of employee relations, General Engineering Laboratory, General Electric Company.

• **AT ST. LOUIS.**—The annual dinner meeting of the St. Louis Post was held in the Gold Room of the Hotel Jefferson on May 5th. The guest speaker was Maj. Gen. E. L. Ford, Chief of Army Ordnance, who paid tribute to the contribution of the St. Louis area and the St. Louis Ordnance District to the ordnance program.

"In recognition of your work in this area," General Ford said, "I must say that from its beginning the Army Ordnance Association, now the American Ordnance Association, has been very close to us, particularly in the technical fields of ordnance.

"The scientists and engineers of industry working with us through the organization of the Technical Committees of your Association are making an outstanding contribution in the mobilization of our scientific and industrial capacity. It is they who are lending assistance to provide superior ordnance equipment in adequate quantities in the event our country must mobilize all its resources for an all-out war."

Speaking on the Ordnance position today, General Ford stated that:

Ordnance spends nearly twenty-five cents of every defense and foreign military-aid dollar;

Ordnance spends about fifty cents of every Army dollar;

Ordnance is the largest technical service in the Army, having more than 160,000 military and civilian personnel;

Ordnance functions in over one hundred installations and activities all over the country;

Ordnance procurement orders are averaging more than 20,000 a month;

The dollar value of these orders for the current fiscal year will amount to at least seven billion dollars;

Tonnage delivered this fiscal year at the current rate will be six times that of 1950 and twice that of last year.

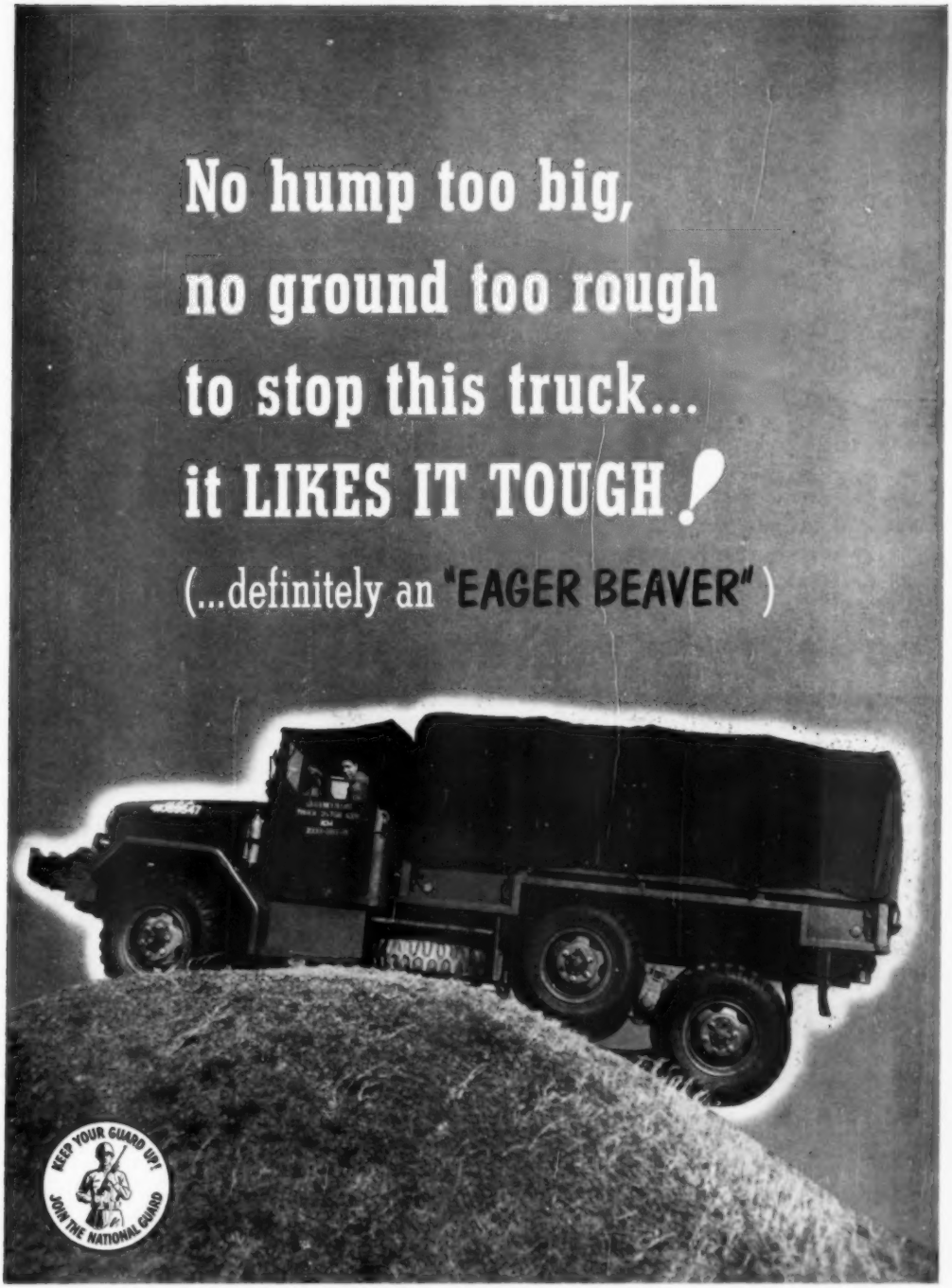
The following members, all officials of Olin Industries, Inc., of East Alton, Ill., received life memberships in the Association: F. S. Elfred, B. E. Bassett, R. R. Casteel, George L. Dawson, W. C. Schade, W. M. Hurley, R. D. Reynolds, M. W. Acker, J. W. Hanes, Fred Olsen, Edwin Pugsley. These awards were made possible by Olin Industries in recognition of outstanding ordnance service in enabling the company to meet with success its many responsibilities in World War II and at present.

James S. Bush, vice-president of the Bank of St. Louis and chief of the St. Louis Ordnance District, was also presented a life membership certificate. Mr. Bush has directed the operations of the district throughout the current rearmament program and has merited the acclaim of industry and the armed forces.

• **AT SPRINGFIELD ARMORY.**—The annual dinner meeting of the Hartford-Springfield Post was held at Springfield Armory on May 16th. Following a tour of the armory, where weapons have been made for the Nation's fighting men for 158 continuous years, the dinner meeting was held in the armory dining room.

Col. Frederick H. Payne, chairman of the board of directors of the Post, presided. The invocation was given by Wing Chaplain Richard R. Potter of the Westover Air Force Base. The toastmaster was Stanley C. Hope, Post president.

(*Continued on page 108*)


No hump too big,
no ground too rough
to stop this truck...
it LIKES IT TOUGH!
(...definitely an "EAGER BEAVER")
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IN THE FRIGID ARCTIC... ...ON THE HOT DESERT SANDS

ANSUL ALL-TEMPERATURE FIRE EXTINGUISHING EQUIPMENT IS YOUR *BEST* PROTECTION

FOR FLAMMABLE LIQUID, GAS AND ELECTRICAL FIRES

Ansul Low Temperature Dry Chemical Fire Extinguishers, Models LT-4-A and LT-20-A, have been tested and approved for operation at 65° F. below zero. These same extinguishers will withstand prolonged exposure to temperatures ranging up to +160° F. They are recommended for use where extreme temperature conditions prevail . . . where other types of fire extinguishers may be inoperative or ineffective.

MODEL LT-4-A ABOVE, CENTER MODEL LT-20-A

Ansul Wheeled and Stationary Extinguishers can be provided with special hose to allow operation at temperatures lower than −40° F.

For flammable liquid fires, Ansul Dry Chemical Fire Extinguishers have the greatest fire-killing ratings ever attained by hand and wheeled portable fire extinguishers . . . Based on tests by nationally recognized approval agencies.

NOTE THESE IMPORTANT ANSUL FEATURES . . .

- Patented nozzle provides most effective stream pattern.
- Easy, on-the-spot recharging. (No tools needed.)
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- Water-tight, corrosion-resistant construction.
- Safe to use on electrical fires.
- ANSUL *"PLUS-FIFTY"*® Dry Chemical is non-toxic, non-abrasive, non-corrosive.

Get the facts. See comparative effectiveness ratings for various types of approved fire extinguishers. Write for File No. 694. You will receive complete information and other valuable data.

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Association Affairs

Brief addresses were given by Col. James L. Guion, commanding officer of Springfield Armory; the Hon. Daniel B. Brunton, Mayor of Springfield; and Leo A. Codd, executive vice-president of the Association. Maj. Gen. E. L. Ford, Chief of Ordnance of the Army, delivered the principal address in which he recounted the great contributions made by Springfield Armory during more than a century and a half. He also described the progress being made by Army Ordnance under the present rearmament program.

Distinguished guests included Comdr. J. W. Fitzpatrick, Maj. Gen. James W. Spry, Col. Jack G. Merrell, Col. Edgar H. Kibler, Jr., Roy F. Williams, and Charles H. Granger.

Colonel Payne was reëlected chairman of the board, and Mr. Hope continues in office as president. Vice-presidents for the coming year are John H. Chaplin, Edward B. Gallaher, and Mr. Granger. J. Alan MacDonnell is secretary-treasurer.

• **AT PITTSBURGH.**—The Pittsburgh Post joined with the Pittsburgh Chapter of the Military Order of the World Wars to cosponsor an Armed Forces Day Dinner in the William Penn Hotel on May 16th.

The speaker was Lieut. Gen. Edward H. Brooks, commanding general, Second Army. His subject was "National Security—Whose Job?" A considerable portion of his talk highlighted and explained Pittsburgh industry's part in national security and today's defense plans.

• **AT WHITE SANDS.**—Ninety-five A.O.A. members from El Paso, Las Cruces, and Carlsbad met at White Sands Proving Ground, Las Cruces, N. Mex., for the inauguration of the El Paso (Texas) Chapter of the Lone Star Post.

The new Chapter received its charter from Maj. R. T. Campbell who represented the Lone Star Post.

Brig. Gen. G. G. Eddy opened the meeting with a hearty welcome to all the members. Following General Eddy's address the meeting was turned over to Col. H. E. Minton, president-elect of the El Paso Chapter, who introduced Major Campbell as the principal speaker.

Among the members attending the meeting were M. S. Derbyshire, Chapter vice-president; C. A. Lindeman, secretary-treasurer; John Davis, president of the Chamber of Commerce of Las Cruces; Capt. A. E. Uehlinger; J. C. Roper; F. W. Wood; H. Karsch; Col. Dan R. Ostrander; Lieut. Col. S. E. Lollis; and Lieut. Comdr. M. F. Green.

(Continued on page 110)

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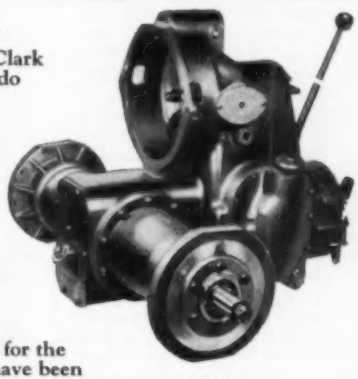

It is a noteworthy habit of machines equipped with Clark transmission-axle units to do a good, efficient job—consistently, dependably.

That fact has led quite a number of leading manufacturers of heavy duty industrial equipment to call CLARK into consultation—to design a special driving unit for a new machine or for redesign of an old one.

There is this to be said for the results: the machines have been uniformly successful—so much so as to establish the Clark Drive Unit as an ingredient for dependable performance.

Working with CLARK may appeal to you, also—as strictly "good business."

This pocket size book briefly describes and illustrates Clark Products. You are invited to send for it.

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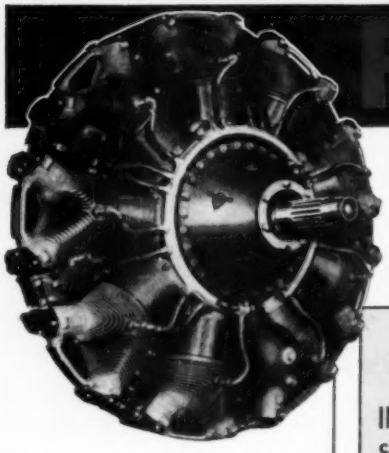

OF INTEREST to all segments of the aircraft industry is the fact that the Continental R-975, as redesigned for helicopter use, is now in production at C.A.E., for such craft as the Piasecki HUP I and HUP II and the Kaman HOK.

The completeness with which this air-cooled radial, rated at 525 h.p., has met the helicopter's high performance standards, suggests its choice for other exacting applications as well. It has special significance for manufacturers of conventional planes.

It offers them a power plant with an *extra margin of stamina,*—a margin proved by performance under conditions far more severe than are imposed on the engine of an airplane of fixed-wing type.

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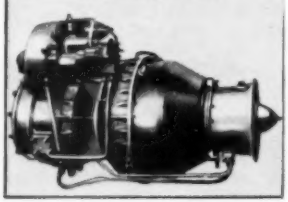
C.A.E. is planning production of the Continental-Turbomeca Family of gas turbines. These advanced power plants comprise four basic types—jet power, shaft power, ducted fan and air compressor—and range from 200 to 1,000 h.p. Tests forecast their wide utility, not only in civilian and military aircraft of medium power, but in numerous other applications, some obvious and others unconventional. We invite inquiries from manufacturers or individuals having specific uses in mind.



There are employment opportunities for engineers and others desiring to make a career in the field of small turbines for commercial and military use. Write giving your background and the type of work desired.

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Association Affairs

Just prior to the meeting, Chapter members were conducted on a tour of the proving ground and witnessed the firing of a guided missile.

• **AT LANSING.**—The Lansing Chapter of the Michigan Post convened in the Oldsmobile Auditorium on April 22nd. A special feature of the meeting was an address by Lieut. Col. Thomas A. Rice, public-relations officer of the Detroit Ordnance District, who had just returned from a 17,000-mile tour of Ordnance installations in Alaska, Japan, and Korea.

Accompanying him were seven press representatives who also spoke briefly at the meeting. They included Leonard Westrate, Detroit editor of Chilton Publications; Stanley H. Brams, chief correspondent, Detroit editorial bureau of *Business Week;* Norman Nicholson of the United Press Association; John Leonard, Detroit editor of *Newsweek* magazine; Siler Freeman, automobile editor of the Detroit *Times;* and Carlisle Carver and Kenneth West of the Lansing *State Journal.*

The presiding officer, L. F. Carlson, Lansing Chapter president, also introduced J. F. Wolfram, vice-president of General Motors Corporation and general manager of the Oldsmobile Division, who delivered the feature address of the meeting on the subject, "Producing for Peace and for War." Mr. Wolfram's illustrated talk showed the Oldsmobile approach to dual-purpose plant operation. His address is published in full beginning on page 73 of this issue of ORDNANCE.

The meeting concluded with the showing of a Navy film on the retreat in the Korean war.

• **AT CINCINNATI.**—As a result of recent elections, the following officers of the Cincinnati Post will serve for a term of two years: Harold R. LeBlond, president; Peter E. Rentschler, first vice-president; Henry V. Heuser, vice-president; Robert G. Calton, vice-president; R. M. Critchfield, vice-president; and Col. Olaf P. Winningstad, secretary-treasurer.

The new board of directors includes Robert S. Gruver, E. Webster Harrison, Mr. LeBlond, Homer E. Lunken, David A. Meeker, E. A. Muller, Frederick V. Geier, Harvey C. Knowles, John D. O'Brien, Louis Polk, Mr. Rentschler, and Harry S. Robinson. National Council member is H. E. Coombe.

Colonel Winningstad has been assigned as deputy chief of the Cincinnati Ordnance District. His last assignment was Ordnance Officer of the Eighth Army in Korea, with his duty in Korea and Japan covering almost six years.

Mr. Polk, retiring president, cited the

★

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"Mom says he is not in Korea any more. So I thought he would come home to us. But now Mom says he is in a Navy hospital and he needs blood to get well. I wanted to help, but they can't take my blood till I am 18. Please give my Dad some blood so he will come home to us soon."

Our Armed Forces require 300,000 pints of blood every month to save the lives of wounded men in hospitals in Korea, Japan and the U. S., and to rebuild reserves that could be wiped out in a single national disaster. The need has *never* been greater. Make your appointment for a blood donation today. And keep it for the sake of thousands of men whose lives still depend upon you.

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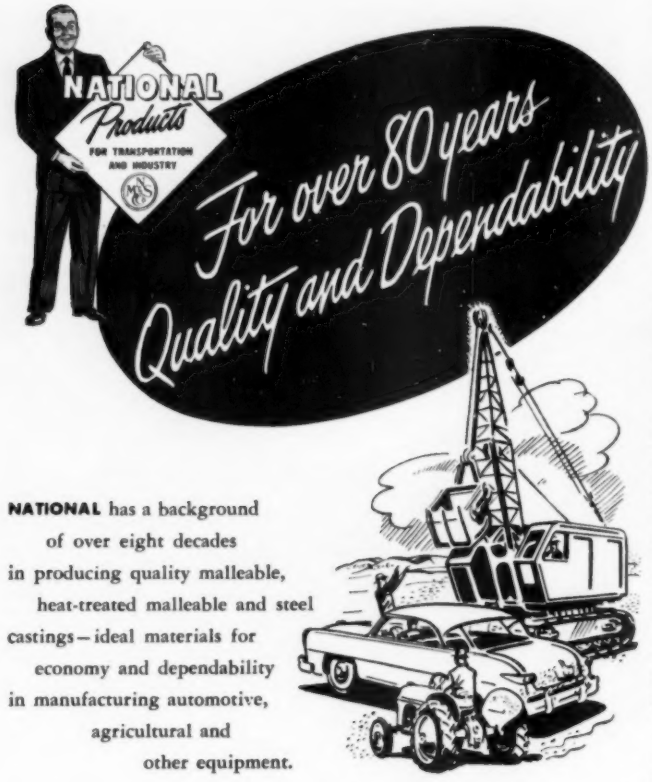
CALL YOUR RED CROSS TODAY!

WHAT HAPPENED TO THAT PINT OF BLOOD YOU WERE GOING TO GIVE?



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NATIONAL'S unparalleled experience—coupled with a continuing metallurgical research program, rigorous quality control standards, and completely mechanized foundries in strategically located cities—is at your disposal.

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A 16mm technicolor film. Narrated by Edwin C. Hill, this 27-minute film tells how malleable iron is made . . . tested . . . used . . . how its production economy, ductility, machinability, toughness will give you a better finished product. Available for group showings. A-5017

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NATIONAL MALLEABLE and STEEL CASTINGS COMPANY
CLEVELAND 6, OHIO

NATIONAL Products FOR TRANSPORTATION AND INDUSTRY Est. 1868

Association Affairs

growth of the Post from 1,754 individual and 39 company members on April 1, 1950, to 2,101 individual and 67 company memberships on January 31, 1952. The Post's national rank has improved from sixth to fifth place among all Association Posts. Mr. Polk will continue to serve the Post on the new board of directors.

• **AT ROCK ISLAND.**—Col. G. Burling Jarrett, curator of ordnance at the Aberdeen Proving Ground, Md., was the principal speaker at the annual meeting of the Quad Cities-Iowa Post following a dinner in the Rock Island Arsenal restaurant, April 25, 1952.

Col. W. W. Warner, commanding officer of the Rock Island Arsenal, greeted the guests at the meeting and outlined some of the newer activities of the arsenal including the Management School. Following his address, Colonel Jarrett participated in a general discussion of his subject.

Directors of the Post who met preceding the dinner meeting included the following: G. L. Weissenburger, Post president, Keokuk, Iowa; P. S. Mumford, Post vice-president, East Moline, Ill.; Col. Carl A. Waldmann, Moline, Ill.; G. A. Uhlmeyer, Rock Island, Ill.; C. E. Murray, Davenport, Iowa; and D. L. Meyers, Rock Island, Ill.

• **AT WASHINGTON.**—Assistant Secretary of the Army Earl D. Johnson was the guest speaker at the annual luncheon of the Washington Post on June 5, 1952, in the South American room of the Statler Hotel, Washington, D. C. A reception was held for the honor guest beginning at 12 o'clock noon. Capacity attendance of 200 marked the occasion. Mr. Johnson is in charge of manpower, personnel, education, and Reserve forces of the Army. Maj. Gen. John K. Christmas, president of the Post, presided.

Arrangements for the meeting were under the capable direction of J. Donald Browne, who, as secretary-treasurer of the Post during the past three years, has rendered yeoman service. Many of the Post's activities, including plant visits, were arranged by Mr. Browne. With his help the Post has established an enviable record of activity.

Always a feature of the annual meeting of the Post is the election of officers. The following were elected for the ensuing year: President, Col. Ludlow King; vice-president, Mr. Browne; second vice-president, W. Richmond; secretary-treasurer, James Sears; and the following directors: George Reviere, George Englemann, T. McCloskey, H. N. Arbuthnot, and A. H. Hobelmann.

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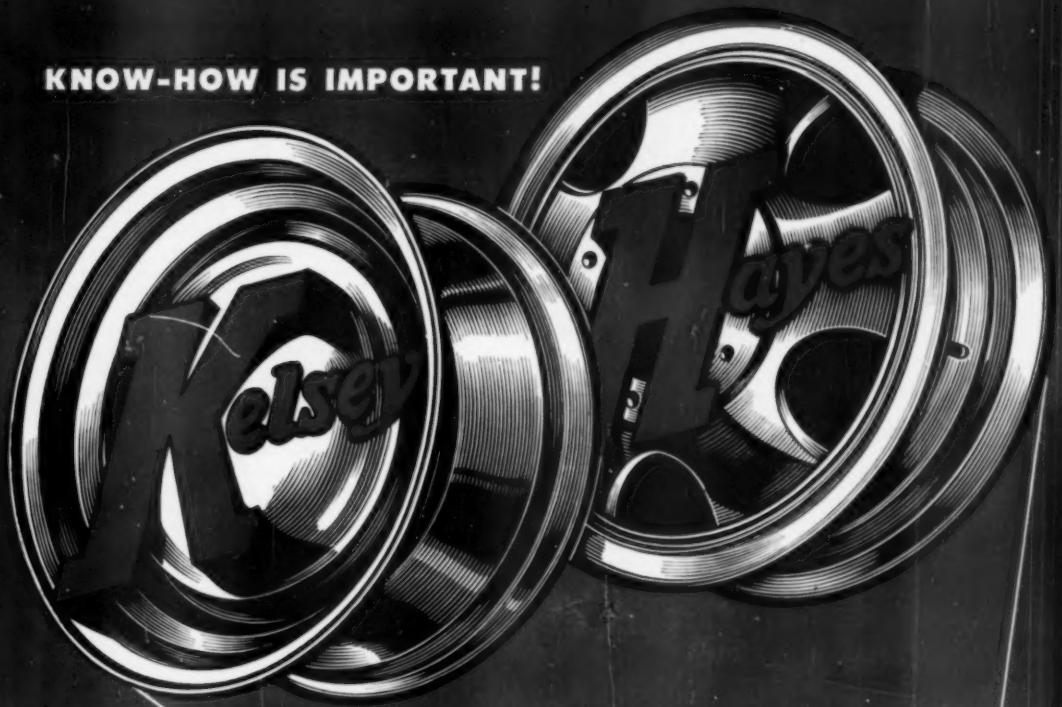

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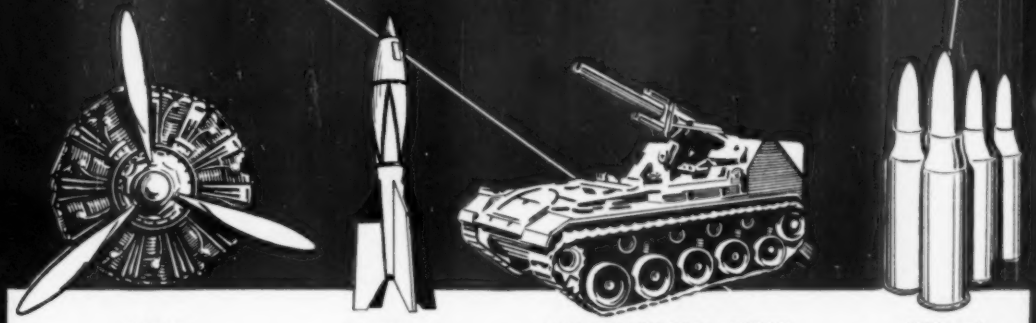

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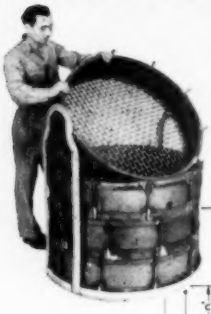

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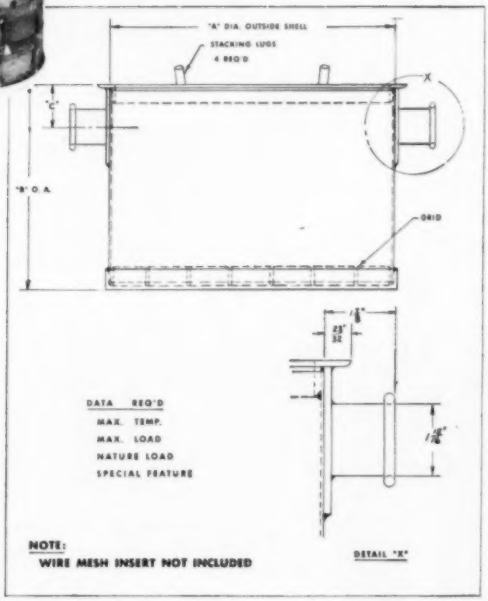

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FROM THE RECORD

OUR ATOMIC WEAPONS

America must maintain its leadership in the field of ideas. I know our sister services join the Army in that belief. I am proud of the way in which our sister services have used atomic energy to help them perform their missions; at the same time, I feel it essential that the public should know what the Army has done to develop and utilize this energy in preparing for defense of the free world.

In its quest for greater firepower, the Army turned quite naturally to seek atomic weapons fashioned for use against an enemy on the battlefield. But recognizing the need for such weapons and building them were two different things.

The first atomic bomb was clearly a strategic weapon designed to shatter such targets as enemy industrial complexes. And in 1945 there was considerable doubt whether it could be adapted in a suitable form and size for tactical purposes. Fortunately, the Atomic Energy Commission, working in close concert with the armed forces, soon dispelled this doubt. *Today we have a tactical atomic bomb that can be used against enemy forces in the field.*

Atomic Artillery

In addition we have developed or are developing other atomic weapons to assist the soldier. We have the prototype of an atomic gun and are training "atomic artillerymen" to use it. This newly developed atomic gun can give the ground commander tremendous firepower at his fingertips and directly under his control. Like conventional artillery, it would be especially effective in defending against attacking ground forces obliged to mass and expose themselves in an assault.

Unlike an air-delivered atomic weapon the atomic gun can function in all kinds of weather, night or day. It is essentially an artillery piece—but with immeasurably greater power than any artillery hitherto known.

Carried on a platform suspended between two engine cabs at front and rear, this highly mobile atomic weapon can travel at a speed of about thirty-five miles per hour on highways. Weighing about seventy-five tons, it can cross bridges which Army engineers are already trained to build for present heavy divisional equipment. It can travel across country and will fit into a landing ship designed for amphibious operations. It can fire with accuracy comparable to conventional artillery, and tests indicate it is much more accurate at long ranges.

In short, the atomic gun can, with the sureness of the traditional field-artillery

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When you have a set of gears in the Sound Tester you can also check tooth bearing. Just use marking compound on one and observe its transfer to the mating gear. When the sound test reveals a nicked tooth the nick may be removed by a pencil grinder while the gear is still in the sound testing machine.

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piece, hit its target under any weather conditions and give ground troops the kind of devastating close support never before available in warfare.

Guided Missiles

To propel atomic projectiles still farther by weapons to hit ground targets—in short, to provide atomic artillery that can far outrange our atomic guns—we are developing guided missiles and rockets to receive atomic warheads. We have been training guided-missile and rocket units for some time, and we are increasing the the scope of this training program.

These are the developments, these are the trends. They are most encouraging; but they are most emphatically no reason for complacency. Most of the atomic weapons for Army use are weapons of the future. But while your Army thinks in the future it must be prepared to fight in the present. We have no desire to delude ourselves as Hitler deluded the German people with his rash promises about German "secret weapons." These secret weapons eventually appeared in the form of V-1 and V-2 flying bombs—but too late to assist materially the German armies fighting with less advanced weapons.

There is no indication today that warfare of the future would not present a continuing need for many of our current conventional weapons. Push-button warfare that would eliminate the man on the ground exists only in the realm of science fiction—and I emphasize the word "fiction" . . .

Although it is too early to foresee the ultimate effects which atomic weapons will have on ground warfare, certain influences are already apparent. It is clear, for instance, that the threat of atomic weapons in future ground warfare will necessitate much greater dispersion of both attacking and defending forces.

Great concentrations of troops and materiel, such as occurred in the Normandy invasion, would assuredly invite atomic attack. In fact, tactics in an atomic war may include attempts to force an enemy to concentrate so that he will present a remunerative target for an atomic weapon.

Favor the Defender

Meanwhile, other things being equal, atomic weapons could favor a defender who had the opportunity to build strong and dispersed defensive positions, particularly below the ground's surface.

Compulsory dispersion of ground units to present unprofitable targets for atomic weapons would bring problems of control and communication. Dispersion of combat units and supply forces make both more vulnerable to guerrilla attacks from enemy partisans. Troop organization to meet this type of warfare might take the form of

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From the Record

small but heavily armed and self-contained units.

To cope with guerrilla attacks—such as we encountered in Korea—soldiers of the so-called rear echelon would have to be trained and equipped to defend themselves to an even greater extent than in the past.

Choosing the Target

The availability of tactical atomic weapons would place high premium on alert combat intelligence agencies. Many appropriate targets such as troops massing in the open for an attack, a river crossing, or an amphibious landing would be fleeting in nature. Aggressive patrolling, skillful and speedy interrogation of enemy prisoners, and the intelligent use of undercover agents would help identify and evaluate these targets in time to engage them with atomic weapons.

I have mentioned these concepts in general terms to give some indication of the thought your Army is giving to its rôle if a general war should ever come in the atomic age. Our doctrine is, of necessity, flexible and varies as new technical developments and weapons appear. But we are evolving this doctrine and publishing it in manuals, consistent with security consideration, to keep our soldiers abreast of atomic developments and to accustom them to including atomic weapons in their tactical thinking.

Nor are we restricting our training in atomic weapons to the publication of manuals. For some time we have been sending Army officers and Army civilian specialists to a joint service school at Sandia Base, N. Mex., where they study the characteristics and use of atomic weapons. We are introducing courses in atomic warfare in all Army schools—from the most basic to the most advanced. These courses include the solution of actual combat problems involving the use of atomic weapons. We intend beginning individual and unit training in atomic warfare in the near future.

In conducting our training in atomic weapons we have considerable experience to draw on within the Army. The Army has played a major rôle in the planning and development of the atomic bomb since its inception . . .

The Cost Factor

It is too early to determine, with any degree of accuracy, the influence which atomic weapons will have on the "cost factor" of our armed strength. We are satisfied that they will eventually provide a greater return in military power for the defense dollar than some of our conventional weapons now afford.—SECRETARY OF THE ARMY FRANK PACE, JR., *before the National Wool Manufacturers Association, New York, N. Y.*

Buttoned-up and navigating blind

Operating tanks with full effectiveness in featureless arctic or desert terrain presents a new problem in "blind" navigation.

Dead reckoning and navigating under such conditions requires electronic and electromechanical systems that are highly complex yet simple to operate and maintain.

This growing field of vehicular navigation is another place where Arma is a leader in basic research, design, development and production. Over 34 years of close cooperation with the Armed Forces—and more recently the Atomic Energy Commission—stand behind Arma's reputation. *Arma Corporation, Brooklyn, N. Y.; Mineola, N. Y.; Subsidiary of American Bosch Corporation.*

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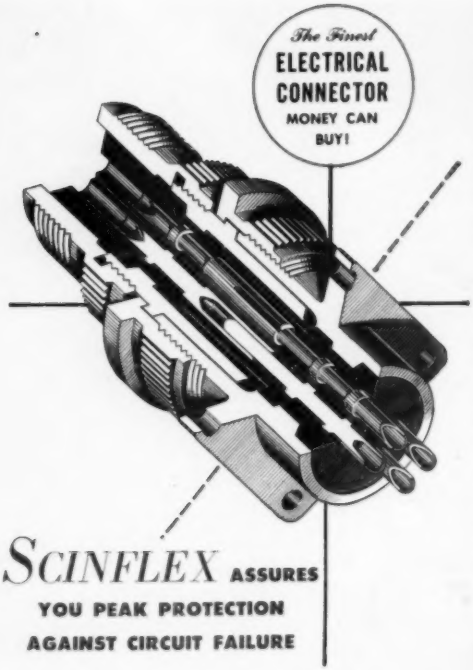

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New DEVELOPMENTS

SYNTHETIC LUBRICANTS

Department of Agriculture and Navy chemists have succeeded in making synthetic lubricants from turpentine. Since turpentine is produced in large quantity in the United States, the discovery is expected to make special lubricants available for military and industrial use at substantially lower cost. Turpentine, largely used as a paint thinner or solvent, has had increasing competition in recent years from hydrocarbon solvents produced from petroleum sources. A major constituent—more than fifty per cent—of turpentine is the chemical, alpha pinene. Dr. L. A. Goldblatt and fellow chemists at the Naval Stores Division, Olustee, Fla., were able several years ago to oxidize alpha pinene and form pinic acid. Then it was found that by using pinic acid in combination with high-boiling alcohols, many excellent new classes of synthetic lubricants could be made.

STREAMLINED JEEP

The Army jeep, after twelve years of thumbing its stubby nose at automobile style dictates, finally succumbed to the national urge toward streamlining. On the new model, being produced by Willys-Overland under a contract with the Ordnance Corps, the hood has been raised and the body lengthened and widened slightly for easier maintenance and to make room for a new 72-horsepower F-head engine which will take the new jeep two-thirds farther with 20 per cent more power than its 428,103 military predecessors produced since 1941. Fenders have been streamlined, not only for appearance, but to serve more effectively as splash and mud guards, and larger springs and new shock absorbers have been added. Soft plastic seats replace the former hard, canvas-covered pads.

The new 72-horsepower streamlined jeep M38A1.

CHAIN RADAR

The complete flight of a guided missile now may be followed through use of a "chain" radar system developed by the Army Signal Corps. This system also makes it possible to obtain accurate ballistic data along the missile's flight path.

The radar chain, located at the White Sands Proving Ground, Las Cruces, N. Mex., consists of several stations spread along the range at advantageous points. Master stations are located at the major missile launching areas and tracking is initiated

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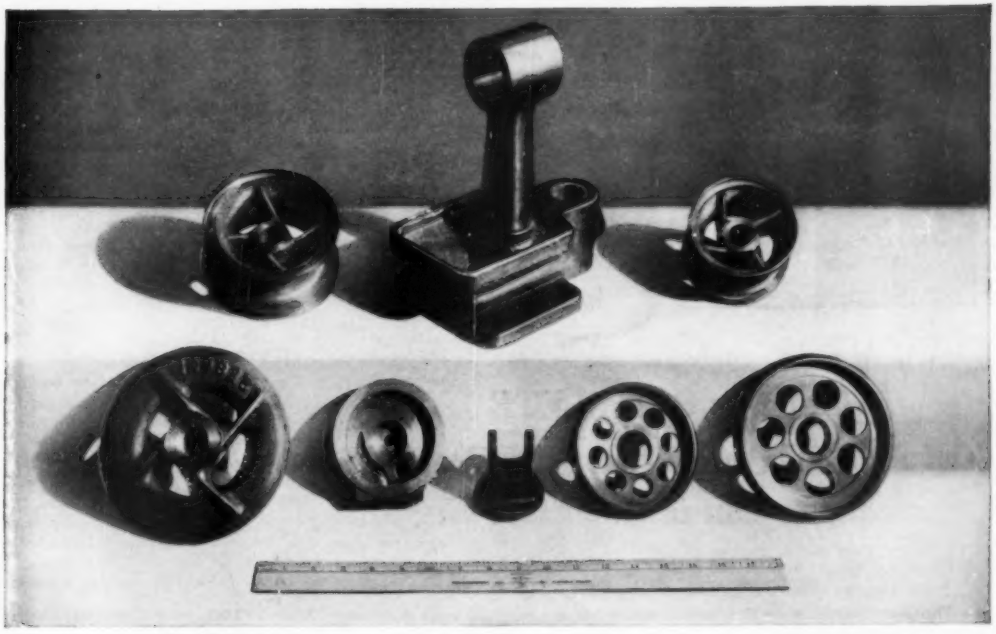

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Eliminate localized hard areas or chilled (white) edges and surfaces . . .

Reduce machining time, tool wear and rejections . . . *raise both quality and quantity of your output by controlling gray iron structure with small ladle additions of NISILOY.*

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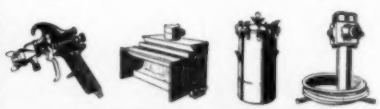

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simultaneously with the launching of a missile. As the missile travels along its course, data from the master station are relayed to the first relay station, automatically positioning the radar set at that station so that the set begins tracking the missile as soon as it comes into range. The process is repeated from station to station.

Data from all stations are automatically and instantaneously relayed back to the master station, enabling observers to watch flight characteristics of the missile. A complete plotting board record is thus provided for use in later discussions and design planning. Range control officers maintain watch on the plotting board to assure that the missile is following its flight path.

Photographic records are made of the radar dials and oscilloscopes. At the terminal end of the missile's flight, radar automatically trains cameras with telescopic lenses on the missile as it dives into the target, providing a record of this vital phase of the missile's trajectory.

STRATOFORTRESS XB-52

The first flight of the new Boeing XB-52 was made recently when the giant, 8-jet Stratofortress was flown from Boeing Field, Seattle, to Larsen Air Force Base, Moses Lake, Wash., where the preliminary phase of testing will be conducted. This is the second XB-52 to be built at Boeing. Details on specifications and armament are classified and the schedule for further flight testing will be withheld from the public for security reasons.

ALL-STEEL PACKAGING

Test trials in the Korean combat zone now are proving the military value of a new type of packaging—an all-steel, combination lock container. Known as the "transporter box," it virtually guarantees the delivery of goods. So far, use of the container nearly has eliminated the inevitable pilferage and damage of long-distance hauling. It also is cutting labor costs in the transportation of cargo. The "transporter," a military adaptation of a commercial container, is relatively small, measuring only 8 feet, 6 inches long; 6 feet, 3 inches wide; and 6 feet, 10 inches high. It has a 300-cubic-foot capacity.

ALUMINUM PLATING

A practical process for electrodepositing aluminum at room temperature has recently been developed by D. E. Couch and Abner Brenner of the National Bureau of Standards. Dense, ductile deposits of the metal are being obtained at the Bureau from a new type of organic plating bath consisting of an ether solution of aluminum chloride and a metal hydride. The new bath is expected to find important application for electroforming

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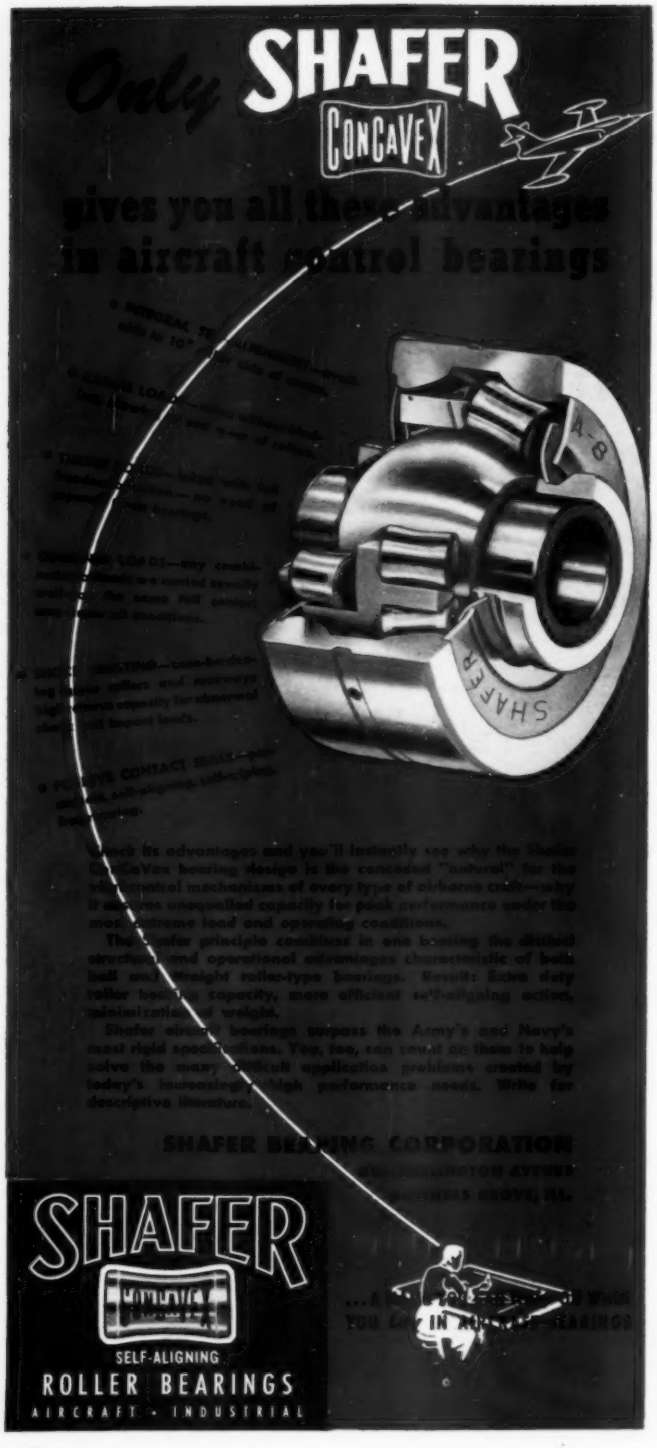


New Developments

articles with close inside tolerances, such as waveguides, and for providing various types of equipment with a thin protective coating of aluminum.

FLYING-BOAT HULL

A radically new flying-boat hull bottom, affixed to the wing and hull crown of a World War II vintage seaplane, is currently being tested on and over the waters of the Chesapeake Bay near Baltimore. Designated as research model M-270, the hull embodies in full-scale the results of years of extensive towing-tank and wind-tunnel tests, according to a joint announcement by the U. S. Navy and the Glenn L. Martin Company, which designed and built the hull in cooperation with the Navy's Bureau of Aeronautics.

The Martin M-270 hull-testing plane.

COMBAT CAMERA

A light, high-speed combat camera developed by the Army Signal Corps features automatic film transport, 4-inch *f*/2.8 lens, and shutter operation permitting ten 1/500-second exposures in only five seconds. The camera uses 70-mm. film, fifty exposures to a roll. A built-in knife permits removal of any exposure desired before entire roll is shot. Combined viewfinder-rangefinder adjusts automatically for use with either normal lens, wide-angle *f*/4.5 or an 8-inch *f*/4 lens. Entire outfit, including carrying case, lenses, filters, flash, and other accessories weighs only twenty-two pounds.

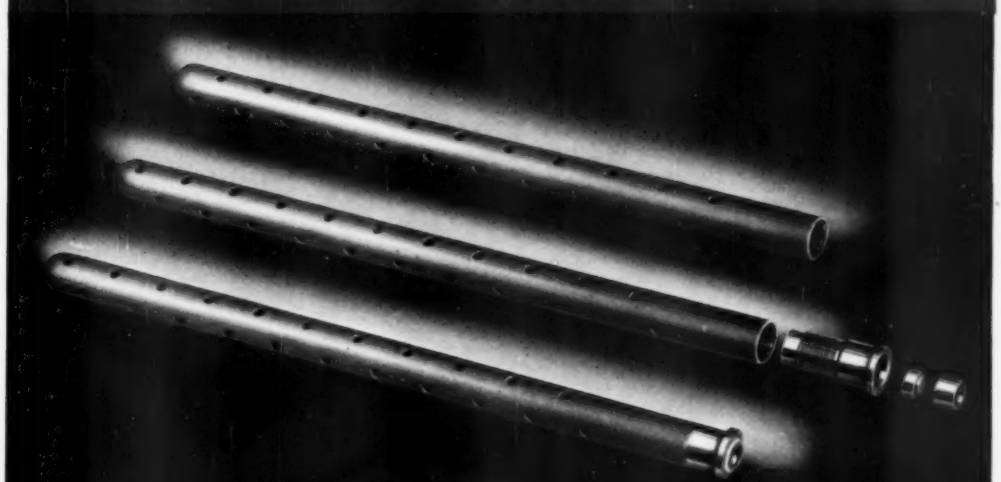
COLLISION RADAR

A new collision-warning radar developed by the Navy Bureau of Aeronautics gives a pilot a constant picture of everything within 200 miles of his plane, whether mountains, other aircraft, or thunderstorms. The radar weighs 250 pounds installed and is pressurized for operation at 50,000 feet. Radar signals can be transmitted in a pencillike beam for obstacle detection and general search or in a vertical fan for mapping and navigation.

FLOATING POWER PLANT

A 34,500-kilowatt floating power plant, being built by the Navy, will be able to supply power needs of most naval shipyards or overseas bases. Three 11,500-kilowatt steam turbines will be installed

These, too, are made by **WOLVERINE**



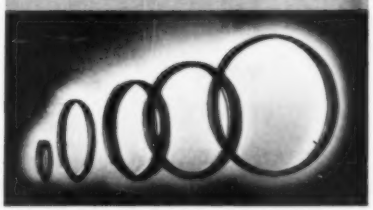
STEEL PRIMER TUBE

This is another item that Wolverine is producing in accordance with government specifications for the defense program. It is a primer tube made in steel and brass. It measures .527″ O.D. and has wall thickness of .036″. The wall is perforated and one end is completely closed by our Spun End Process*—a very efficient process developed by Wolverine.

Research and development is going on at Wolverine constantly, through preparedness programs and during normal times—having started thirty-six years ago. This extensive experience is available to you without obligation. Equipped with a good understanding of government requirements, we can offer you much valuable assistance. **WOLVERINE TUBE DIVISION,** Calumet & Hecla Consolidated Copper Company, Inc., *Manufacturers of seamless, nonferrous tubing,* **1467 CENTRAL AVENUE, DETROIT 9, MICHIGAN.**

*A PATENTED PROCESS RE22468

also
ROTATING BANDS



These rotating bands are cut to required specifications from Wolverine seamless tube of either *all* copper or gilding metal. Sizes range from 20mm to 105mm.

If it's tubular, we can help you produce it. Send us your prints for consideration and quotation.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Company, London, Ontario.

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

AMERICAN CHEMICAL PAINT COMPANY
AMBLER PENNA.

Technical Service Data Sheet
Subject: RUST PROOFING WITH PERMADINE®

INTRODUCTION:

Ferrous metal parts that have been Permadized in a zinc phosphate chemical solution and then "sealed" with a rust-preventive oil such as "Granoleum" are effectively protected from rust-damage. In addition, if the surface is accidentally chipped or scratched, rusting is confined to the exposed area.

Rust proof coatings find many practical applications. During World Wars I and II most small arms were rust proofed by phosphate coating and impregnated with chromic acid and a rust preventive oil, or cutback petrolatum. This not only provided excellent corrosion resistance but also yielded a dull black non-reflecting surface. Rust proof finishes are now used widely on hardware, firearms, cartridge clips, metallic belt links, miscellaneous forgings and castings, tools, unpainted replacement machine parts, and many other similar items such as bolts, nuts, and washers.

THE PERMADIZING PROCESS:

For the most effective rust proofing of large or small work in large or small production, "Permadine" is used in tanks in an immersion process, with the bath heated to 190°-210°F., coating time 20 to 30 minutes. The coated parts are then rinsed in clean water, and then in a controlled dilute acidulated solution. After drying, a suitable corrosion-resistant oil such as "Granoleum" is applied.

Operations can be carried out with the work in crates, or hung from hooks, utilizing an overhead rail and hoists. For large volume production, automatic equipment can be used to mechanize the line. Small parts can be treated in tumbling barrels.

"PERMADINE" MEETS SERVICE SPECIFICATIONS:

The protective "Permadine" finish meets U.S.A. 57-0-2C; Type II, Class B, and equivalent requirements of:

MIL-C-16232,
Type II
U.S.A. 51-70-1,
Finish 22.02, Class B
AN-F-20
Navy Aeronautical M-364
JAN-L-548

"PERMADINE" DATA CHART

Type of coating	Zinc phosphate
Object of coating	Rust and corrosion prevention
Typical products treated	Nuts, bolts, screws, hardware items, tools, guns, cartridge clips, fire control instruments, metallic belt links, steel aircraft parts, certain steel projectiles and many other components
Scale of production	Large or small volume; large or small work
Method of application	Dip Barrel tumbling, racked or basketed work
Equipment notes	Immersion tanks of suitable capacity. Cleaning and rinsing stages can be of mild steel. Coating stage can be of heavy mild steel or stainless steel.
Chemicals required	"Permadine" No. 1
Pre-cleaning methods	Any common degreasing method can be used. Alkali cleaning ("Ridosol"), Acid cleaning ("Deoxidine"), Emulsion-alkali cleaning ("Ridosol"-"Ridoline"); vapor degreasing, solvent wiping, etc., are examples. Acid cleaning may need to follow other cleaning methods if rust or scale is present.
Bath Temperature	190° - 210°F.
Coating time	20 - 30 minutes
Coating weight range Mgs./Sq. Ft.	1000 - 4000
Technical Service Data Sheets	No. 7-20-1-2 T. M. No. 5

CHEMICALS ACP PROCESSES

WRITE FOR FURTHER INFORMATION ON "PERMADINE" AND YOUR OWN METAL PROTECTION PROBLEMS

CHEMICALS ACP PROCESSES

New Developments

in the Minesweeper, COASTAL RACER, a C1-M-AV1 design hull with a length of 338 feet and a 50-foot beam. The unit, without propulsion power, will be towed to stations where needed.

PLASTIC PATCHING

A plastic patch for pipes developed at the Naval Damage Control Training Center, Philadelphia, can be applied in seven minutes and will withstand working pressure twenty minutes later. Patching material consists of fibrous glass cloth, resin and activator, and fibrous glass tape. No surface preparation other than wiping dry is required, the patch will work over jagged ruptures or sunflower bursts and will even join two ends of completely severed pipe. The patch is not affected by gases or liquids in shipboard lines, with exception of high-temperature material. No outside heat is required in applying the patch.

NEW RESCUE HELICOPTER

A new U. S. Air Force rescue helicopter, the YH-21, made its first flight recently at the Philadephia Airport plant of Piasecki Helicopter Corporation. Designed for arctic missions, the YH-21 is capable of carrying sixteen persons, or twelve litters plus a medical attendant in addition to the pilot and copilot. The tandem, twin-rotored transport has a greater load-carrying capacity than any helicopter now in the U. S. military service. A hydraulic rescue hoist will lift a man, a litter, or 400 pounds of equipment while the aircraft is in a hovering position. The operating ceiling is over 16,000 feet.

"THE FINGER"

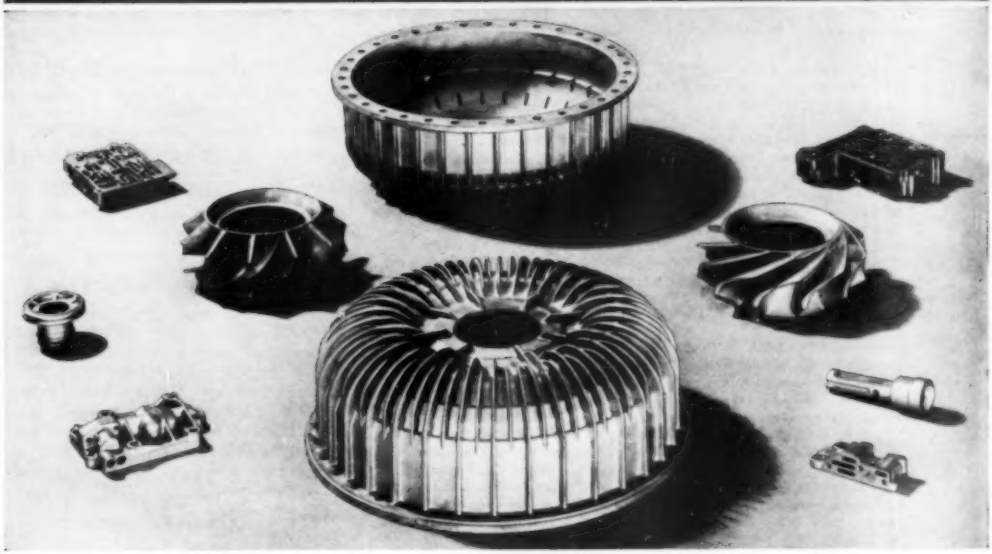
Putting the finger on deadly atomic rays in planes flying over A-bomb blast sites is the job of a recently declassified electronic device which looks like and is called "the finger." Developed and built by the General Electric Company's tube department, the instrument more technically is known as an ion chamber but is far smaller than other gamma-ray detectors of the same type and sensitivity.

The small size of the instrument is achieved by compression of argon gas inside the chamber under fifty times atmospheric pressure. Gas equal in volume to a quart is compressed into a portion of the tube less than four inches long and only three-quarters of an inch in diameter. When gamma rays penetrate the steel wall of the chamber, the gas acts as an electrical connector between two electrodes, registering the amount of gamma radiation on a meter.

EMERGENCY MILITARY CONSTRUCTION

The Army Corps of Engineers has completed a 2-year program to provide new

No Problem's Too Tough
when you call in ... PRECISION



In producing these aluminum die castings for the—

Fordomatic and MERC-O-MATIC

Torque converter and automatic transmissions (designed and engineered by the Ford Motor Co. and Borg-Warner Corp.), Precision Castings Company solved these problems

- Adapting the original designs so that these parts could be die cast — considerably reducing the cost of each.
- Superior die making skill and casting techniques made possible the production of castings requiring highly complicated coring methods.
- Delivery of castings requiring little or no machining.
- Production of castings with extremely close tolerances.
- Assurance of an unfailing supply of castings in a short-supply metal market through Precision's research and development of a high strength alloy to ASTM and SAE specifications using secondary aluminum.

Since 1909 the name "PRECISION" has been the symbol of highest quality in the die casting industry.

PRECISION CASTINGS CO., Inc.
212 Walnut St., Fayetteville, N. Y.
Syracuse, N. Y. · Cleveland, O. · Kalamazoo, Mich. · Chicago, Ill.
British Affiliation — Wolverhampton Die Casting Co., Wolverhampton, England

Rockwell Report

by W. F. ROCKWELL, JR.
President
Rockwell Manufacturing Company

PRODUCT RESEARCH is the life blood of a growing company. That's why, for long range research, we maintain several full time fellowships at educational institutions. And that's why we operate laboratories at the division level throughout our company. Here research is localized and directly relates to the products built in that particular plant. Each development program must have a commercial objective. So research projects are always weighed against manufacturing facilities, ultimate product costs, available distribution channels, etc. In other words, we ask ourselves: If the research proves successful, will it in some way strengthen this company?

Not all product research is done in our laboratories, however. Some of the best and most practical product development suggestions come from foremen, methods engineers and employees along the production lines. It is for this reason that we feel the future of the company depends not alone upon the calibre of its research personnel, but also on the opportunities and recognition given its whole working force.

* * *

Practically all gasoline and fuel oil is now metered from bulk storage plants into tank trucks. At big bulk plants there may be from twelve to twenty attendants each loading a truck at the same time. In such an operation, guiding traffic and keeping accounts straight can be a managerial headache.

Our Meter Division has now developed a remote registration system to provide control over every load from a central office. Duplicate printing type registers are installed in a bank under the eyes and hands of a dispatcher. Each of these registers is electrically synchronized to one of the meters on the loading rack. No product can be drawn until the dispatcher sets the register and activates the proper electric circuit.

* * *

One of the "hit" products on display at the recent American Society of Tool Engineers' show was a new air-powered hydraulic drill head built by our Delta Power Tool Division.

This Delta drill head operates in any position, can be set up in groups to do several simultaneous machining operations on a single piece, and is completely flexible so that a manufacturer can adapt it to his own special machining problems. With a rapid approach and return (5 to 6 inches per second) it has a low non-productive cycle. Its low cost makes it possible for metalworking plants to build a special set-up for many jobs that would otherwise have to be done in a series of operations, or on special machines costing ten to twenty times the Delta drill head.

* * *

Diversification is a basic concept in the operation of the Rockwell Manufacturing Company. Long ago we found that no company can diversify adequately in one business or in one plant. In the process of dispersing our plants from Brooklyn, N. Y., to Oakland, Calif., we have learned an important lesson:

Management is simpler in a plant having around 500 or less employees than in a larger operation. Many of the human problems of employer-employee relationships disappear through direct personal contact.

Small, independent companies suffer, however, in today's complex business economy because of the high cost of necessary and specialized legal, tax, research, engineering and marketing guidance.

Under the Rockwell plan, our divisions and subsidiaries have a high degree of autonomy, are locally managed, and an integral part of their own communities. Yet, associated with each other, they are able to easily afford a staff of experts in each field of modern business management.

One of a series of informal reports on the operations and growth of the
ROCKWELL MANUFACTURING COMPANY
PITTSBURGH 8, PA.
for its customers, suppliers, employees, stockholders and other friends

New Developments

designs for emergency-type military construction. The designs, which cover 245 different types of buildings, will be used in the event of an emergency requiring the most expeditious and economical construction. Buildings are designed for a life expectancy of three to five years, and designs have been prepared for three temperature zones.

A camp for an Infantry division would require about 910 buildings of emergency design. Approximately twenty-five per cent of these buildings would be barracks. The new barracks plans call for a simple one-story, U-shaped building instead of the mobilization type used during World War II. Barracks will house eighty men. The net allowable space per man for both designs is sixty square feet. Experience gained in the construction of mobilization-type buildings during World War II was utilized in preparing the new designs.

NEW BRITISH CATAPULT

A new British aircraft catapult, regarded as one of the important developments for naval aviation since World War II, will be adapted for use on U.S. aircraft carriers. Nicknamed the "steam slingshot," the new steam-powered catapult proved in recent tests that it can hurl the U.S. Navy's jet fighters into the air even when the carrier is headed down wind.

ICE MEASURING DEVICE

Through the use of what is believed to be the first automatic ice-gathering device ever developed for planes, Northrop Aircraft, Inc., has been able to obtain vital data to determine icing conditions on the F-89 Scorpion. This latest development for the study of icing conditions consists of three cylinders on the port side of the forward fuselage which are extended about eighteen inches to collect ice and then retracted into special refrigerated chambers where they remain until the plane lands.

GIANT BETATRONS

Three 24,000,000-volt betatrons, the first ever built for industrial operation, are now being used in eastern and midwestern steel foundries to help speed the production of vital armor steel castings required in the Army's tank program.

Powerful enough to penetrate seven to nine inches of steel armor in little more than a minute, the new X-ray giants greatly speed and improve inspection techniques formerly requiring hours and days.

NEW GUN LUBRICANTS

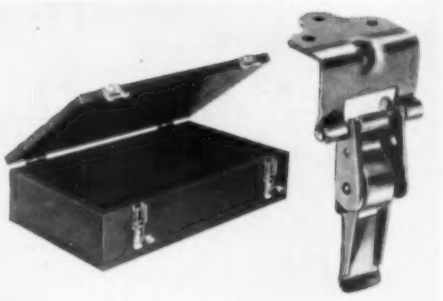
A lubricant system developed by chemists of the Naval Research Laboratory of the Office of Naval Research

Have you a fastening or clamping problem?

IF YOU HAVE, CHANCES ARE BASSICK HAS A DEVICE TO SOLVE IT

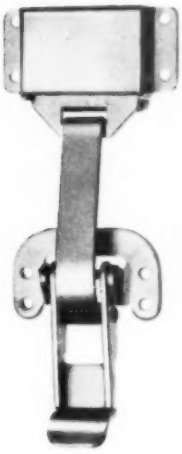
Catches and fasteners, for everything from jeep hoods to tool boxes, kits, and containers, are available from Bassick . . . either "standard", like the four shown, or adaptations to meet your special needs by Bassick development engineers working with you.

For many years, Bassick has been a leading supplier of specialty hardware to the automotive and other top industries . . . in addition to being the world's largest manufacturer of casters.



Combination Latch-Hinge (ZLA-1020, ZLA-1009)

A truly versatile fastener! Clamps on one side in locked position are acting as hinges, while the clamps on the other side are open, permitting entrance to the box, which can be opened from either side. Lid easily removed by unlocking all four fasteners.



Back View

"Power-Pack" (ZLA-1104)

This behind-the-catch view shows why this clamp won't loosen even under the roughest handling or vibration. There are *100 lbs. of tension* compressed in these springs, but it is not a "knuckle breaker"! Ideal for operation in sub-zero temperatures.

Flush Type Clamp Assembly

(ZLA-1098)

These clamps are fully recessed to allow close stacking of the crates, boxes, etc., on which they're installed. Arm is spring-loaded to work easily and grip the latch firmly. Hole for inserting padlock or shipping seal.

Heavy-Duty Hood Fastener

(C-4017)

"Catching" vehicle hoods is but one of the many uses for this type of fastener. It always provides a dependable and economical "hold", yet allows easy access to encased units. Bassick makes many sizes and styles.

Write for Specialty Hardware Catalog, showing our extensive line, or address your problem to THE BASSICK COMPANY, Bridgeport 2, Conn. *In Canada*: Belleville, Ont.

Bassick

A DIVISION OF STEWART SW WARNER

MAKING MORE KINDS OF CASTERS . . . MAKING CASTERS DO MORE

Need Conveyor Chain? NOW

We're In Position To Make
IMMEDIATE DELIVERY

X458 Drop-Forged

Rivetless CONVEYOR CHAIN

Improved production and material conditions have enabled Jervis B. Webb Company to stock an adequate supply of X458 Chain—ready for immediate delivery—to meet your conveyor system needs.

The No. X458 Drop-Forged Rivetless Chain for Trolley Conveyors (illustrated above) has the improved webbed side link which substantially stiffens it. Also, this type link prevents telescoping of the chain while in service. Simple and strong, it is cheaper and lighter per unit of ultimate strength than any other type of conveyor chain. It can be installed or removed by unskilled labor. Having no rivets, welds or bolts, X458 Chain requires no special or joining links and may be disconnected at any point, yet it is so designed that it cannot become disconnected while in service. No. X458 Chain is completely interchangeable with the Webb FIRST—the original No. 458 Chain designed in the early Twenties by Mr. Jervis B. Webb.

Send us your specifications and requirements. Prompt reply promised.

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OFFICES IN PRINCIPAL CITIES

FACTORIES IN DETROIT . . . LOS ANGELES . . . HAMILTON, ONT.

allows Navy and Marine Corps aviators to fire their 20-mm. M3 automatic aircraft cannon at altitudes of 30,000 feet and higher.

Four synthetic lubricants make up the new system: (1) a light oil for the gun mechanism itself; (2) a lubricant for the ammunition; (3) a water-repellant lubricant for the electric trigger; and (4) a grease for the mechanism that automatically feeds the ammunition to the gun. Use of the "tailor-made" lubricants has permitted nearly constant rates of firing of the cannon at temperatures from 150 degrees above zero Fahrenheit to 70 degrees below, without the need for auxiliary heaters previously required at temperatures below minus 20 degrees.

"THE SQUID"

Recently released from secrecy restrictions by the British Admiralty is the Royal Navy's new and deadly antisubmarine weapon, "The Squid." Fired from the stern, the multibarreled mortar shoots a pattern of depth charges right over the ship to explode 300 yards ahead. The accompanying photograph shows the Squid being loaded on the quarterdeck of H.M.S. DARING, the Royal Navy's largest and most powerful destroyer, during exercises in the English Channel. The bombs used in the trials were dummies, but the real ones are claimed destructive enough to crush the toughest submarine hull.

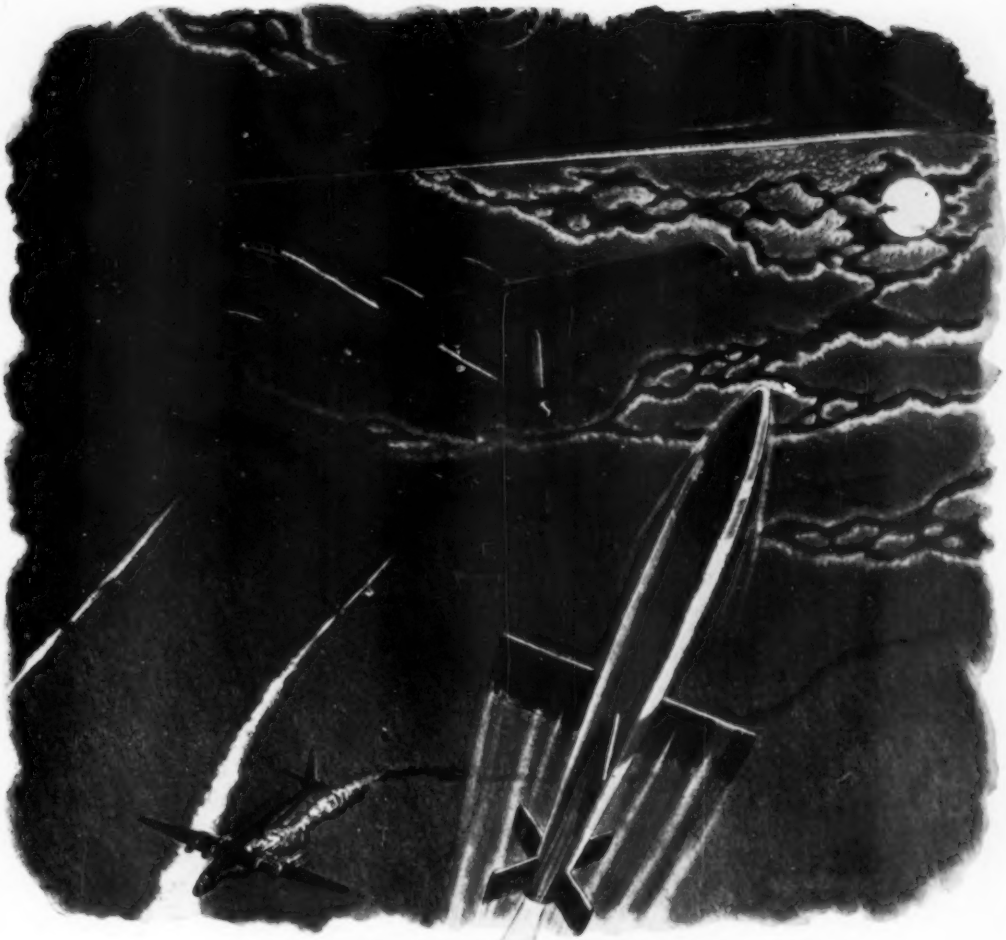
The Squid being loaded with depth charges.

WATER-REPELLENT THREAD

To prevent the seepage of water through seams of water-repellent Army clothing, the Quartermaster Corps has developed a successful water-repellent treatment for thread used in sewing these garments. Tests have shown that untreated thread serves as miniature wicks along which water, falling as rain or snow, seeps through the clothing and thus reduces the protection expected from water-repellent fabrics.

TRANSSONIC WIND TUNNEL

A transsonic wind tunnel at the Navy's David Taylor Model Basin, when com-



NO PLACE TO HIDE!

Guided missiles now under development will make the skies dangerous for any future attacker. Neither weather, cloud layers nor night will offer him protecting cover. Radar homing missiles such as those being designed by Fairchild's Guided Missiles Division will —literally—leave No Place to Hide.

With its "Lark" missile used in training programs by all three branches of the Services — the Navy, the Air Force and the Army Field Forces—the Fairchild Guided Missiles Division is a leader in the guided missile field. In its "Lark" Fairchild has developed one of the most advanced guidance systems.

Because of the "Lark's" advanced guidance system, range has no effect on its accuracy. In addition, logistic support of missile batteries using the basic "Lark" guidance system is simpler, since the ground control requirements are less.

While the "Lark" today is a superb training missile, Fairchild Guided Missiles engineers are designing and developing new and vastly improved missile systems for tactical applications. At Wyandanch, L. I., Fairchild's Guided Missiles Division has just opened the first privately-built plant devoted exclusively to missile development and production.

ENGINE AND AIRPLANE CORPORATION

FAIRCHILD *Guided Missiles Division*

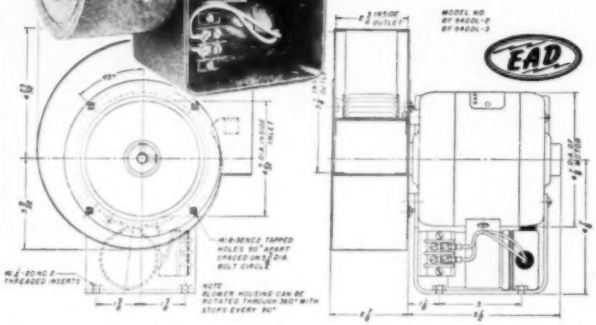
Wyandanch, L. I., N.Y.

Other Divisions: **Aircraft Division,** Hagerstown, Md. • **Engine Division,** Farmingdale, N.Y. • **Stratos Division,** Bay Shore, L.I., N.Y.

EAD... "TAKES THE HEAT OFF"

ANOTHER ENGINEERING PROBLEM

A compact, highly efficient centrifugal blower for cooling "hot-running" electronic equipment.



SPECIFICATIONS

MODEL NUMBER.....BF 94 DDL-2

CAPACITY..250 CFM at .5" Static Pressure NAFM
330 CFM at .0" Static Pressure

MOTOR *(Self Cooling—Completely Enclosed)*
⅛ H.P., Capacitor Induction,
120 Volts, Single Phase, AC,
60 Cycles, 3200 RPM,
Clockwise or Counter Clockwise.

MOUNTING .....Rigid Base

OVERALL
DIMENSIONS .....7 27/32" x 8 3/8" x 10 1/8"

Solving special problems is routine at EAD

If your problem involves rotating electrical equipment, bring it to E A D. Our completely staffed organization will modify one of our standard units or design and produce a special unit to meet your most exacting requirements.

EASTERN AIR DEVICES, INC.

585 DEAN STREET, BROOKLYN 17, NEW YORK

New Developments

pleted late in 1953, will permit testing of models at speeds up to 900 miles an hour. The tunnel, based on a design partly built by the Germans near Munich, will be of the closed-circuit type, 574 feet long. The wind going through this tunnel will be from a 19-foot double fan with contra-rotating blades.

NEW BRIDGES

A new series of military bridges designed to carry heaviest equipment used by field armies or divisions is being developed by Army Engineer Research and Development Laboratories. Bridges include floating and fixed types of aluminum and steel. Floating bridges utilize pneumatic pontoons made of neoprene-covered nylon, compartmented to withstand gunfire. Other pontoons are fabricated of aluminum or plastic.

REACTIVATED ORDNANCE WORKS

The Army Ordnance Corps will reactivate three remaining production lines at the Indiana Ordnance Works with initial production starting in May 1953. The first three lines are now being reactivated and started production in June. Total output will consist of smokeless powder. A bearings plant at Rolla, N. Dak., will also be activated by the Ordnance Corps using buildings and World War II surplus machinery for the manufacture of jewel bearings. American Indians, adept at making small beads, will be taught the special skill needed for turning out these minute bearings.

PILOT'S WARNING

An automatic warning device developed at the Air Force School of Aviation Medicine monitors the oxygen content of a pilot's bloodstream and warns the pilot when oxygen saturation falls to eighty per cent (normal is ninety-eight per cent). Main feature is a minute lamp and photoelectric cell built into the ear cover of the pilot's headset. Infrared light passing through the transparent ear cartilage is impeded by the blood and changes to darker red as oxygen supply fails. The cell transmits the changing electrical impulse to a control set which actuates either a flashing red light or an audible signal when the danger point is reached. The device has been tested in altitude chambers up to 80,000 feet.

CONCAVE CONVEYOR

A new type of concave roller conveyor, designed especially for handling all types of cylindrical objects such as shells, was announced recently by the Alvey-Ferguson Company. The new conveyor keeps the cylindrical objects in the center of the conveyor line thus preventing them from slipping to either side or sliding off.

New Wrap for Government Packaging . . .

HPS

SELF WRAP

WAXED · CREPED · MOLDABLE

conforms to
JAN-B-121
Grade A • Type 2 • Class 2
•
Barrier Materials • Greaseproof

SELF WRAP

is a heavy duty wrap, wax impregnated, and creped for closely molding to various shaped pieces without rupturing. It fully conforms to the requirements of

GOVT. SPECIFICATION

BARRIER MATERIALS

other grades listed at right

•

JAN-B-121
Barrier Materials • Greaseproof

JAN-P-117
Bags • Interior Packaging

•

All Grades available on DO orders only

Arctic Pak 1 • Flat POLYETHYLENE (LOXOL PROCESS) COATED KRAFT
JAN-B-121 • Grade A • Type 1 • Class 1. Flexible to 65° below zero. Heat Sealable, greaseproof, waterproof.

Arctic Pak 2 • Flat POLYETHYLENE (LOXOL PROCESS) COATED KRAFT
JAN-B-121 • Grade A • Type 2 • Class 1. Flexible to 65° below zero. Heat Sealable, greaseproof, waterproof.

Arctic Pak 1 • Creped POLYETHYLENE (LOXOL PROCESS) COATED KRAFT
JAN-B-121 • Grade A • Type 1 • Class 1. 15% stretch; molds to any contour, Heat Sealable, greaseproof, waterproof.

Penguin Pak POLYETHYLENE (LOXOL PROCESS) COATED KRAFT
JAN-P-117 • Grade A • Type 1. Classes a-b-and c. Heat Sealable, greaseproof, waterproof.

Lamine 1 GLASSINE LAMINATED TO KRAFT
JAN-B-121 • Grade A • Type 1 • Class 1. High tensile strength; greaseproof.

Lamine 2 GLASSINE LAMINATED TO KRAFT
JAN-B-121 • Grade A • Type 2. Class 1. High tensile strength; greaseproof.

HPS Technical Staff is fully experienced and prepared to assist you in working out problems related to government or civilian packaging. Ask for complete test, size, and price data on all of the above grades.

Write HPS
for samples and specifications of Self Wrap and other HPS materials for Government packaging.

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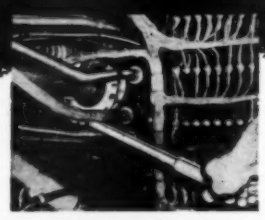
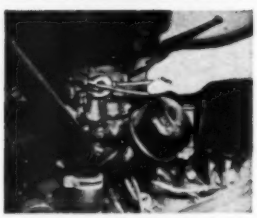
For generations Tool Engineers have tried to develop a practical Open End Ratchet Wrench. Now *TAC* has done it... both as a socket type and as a Crowfoot type.

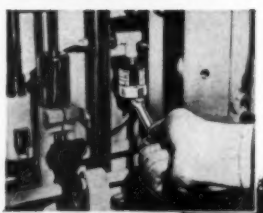
And what a marvel TAC is! *It ratchets in as little as 7° arc.* It slips over and down on tubing or other standing center assemblies, tightens or backs off nuts or fittings, then slips off again... all in a mere fraction of the time otherwise required. Sockets cover the range from ¾" to 4"... and adaptors carry the tool's advantages over into Allen head, turnbuckle or screwdriver operations!

Proof of TAC's phenomenal performance throughout all Industry would fill volumes. Our plants are currently producing at capacity for all the Armed Forces and for Defense Industries.

The TAC Open End Ratchet Wrench is fully protected by Patent numbers 2578686 and 2578687, other patents pending. The name TAC is the registered trademark of TUBING APPLIANCE COMPANY.







TAC

TUBING APPLIANCE CO.
10321 ANZA AVENUE
Los Angeles, California

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COMMUNICATIONS

HAPPENING HERE?

THE EDITORS.—I have just read the recent edition of THE COMMON DEFENSE and I noticed in the book service section your description of Herbert A. Philbrick's "I Led Three Lives." I have not read this book, but I believe I have read excerpts from it in *Reader's Digest* and other periodicals. As pointed out by you, "it can happen here" and "it is happening here," and I noticed also the reference that "loyal Americans owe it to themselves to read this book."

This and many other excellent reports bring to our attention a vigilance that is needed to protect this country from subversive inroads. What are we doing, however, about some of the very agencies which are supposed to be investigating such things and are themselves subject to question in their motives and direction?

I refer to what I consider an excellent exposé of the functioning (or failure to function) of many of our Government agencies which has been very pointedly brought out in another book, "U.S.A. Confidential," by Lait and Mortimer.

This book, while leaning toward the dramatic, certainly describes things which, were they not true, would certainly expose the authors to libel suits and possibly even violent physical reaction. I would recommend the reading of this book by all loyal Americans, especially if they have children.

Another thing which has been bothering me lately is the terrific drive in the United States for scrap steel, even to the extent where trade publications are begging individuals to collect old plows, anvils, etc. I cannot reconcile this scrap-steel shortage with a situation which must certainly be within the Government's ability to act upon.

I refer specifically to the great tonnage of steel rusting away in the form of World War I freight ships at Stony Point in the Hudson River. I should imagine that this is just one instance of such masses of steel that could be converted to the good of the country, but as far as I can see nothing is being done about it.

This is not a "gripe" letter. I am really curious as to why such things are allowed to proceed as they do.

T. C. FREEDOM

Dillsburg, Pa.

■ **The Editors welcome comment and constructive criticism from our readers. Letters should be typewritten, double-spaced, and should bear writer's full name and address.**

A Big Help in Metal Finishing!

United Chromium specializes in coatings to solve problems in

❶ electroplating ❷ organic finishing ❸ chromate treating

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A large automotive supplier is producing a corrosion-inhibiting finish on zinc die castings with more ease and less expense since switching from a "home made" chromate solution to a Unichrome Dip. This move reduced costs of materials alone by nearly a third. And there's less trouble getting as good or better corrosion resistance than before.

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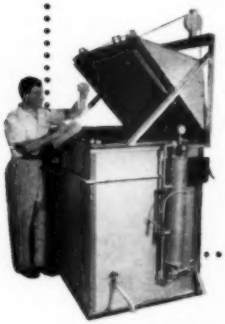

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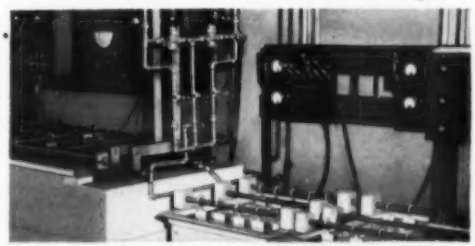

REMARKABLE IMPROVEMENT IN CHROMIUM PLATING Hard chromium plating in the Unichrome S.R.H.S. Chromium Solution reduces plating time, control problems, finishing time, and costs. Here's why: This solution plates 20 to 80% faster than the ordinary bath. It plates with less "treeing" and levels over minor surface irregularities. A self-regulating bath, it needs less attention for good results. These features explain why one plant was able to halve production time on plated bushings by switching to this bath.

For help on your specific finishing problem, why not write or phone the United Chromium office nearest you?

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Operation Overload. By Albert Norman. Harrisburg: Military Service Publishing Company. 230 pp. $3.75.

THE invasion of Europe in World War II—the greatest military operation in modern times—is here simply, clearly, and completely discussed by an historian whose writing style is very kind to the normal reader. This is a tactical and strategic account of an operation which the average person will enjoy as he would relish a good fiction story. The reader is not required to have any prior knowledge of the subject nor is facility with military strategy or logistics necessary.

The author has clarified, in a few pages, the long-drawn-out United States-British controversy regarding the Mediterranean versus the Normandy coast as a location for the initial invasion.

The author says in his foreword, "In writing this story I have, in the main, laid greater emphasis on the events and their unfolding. Interpretation I have generally left to the judgment of the reader, for I believe that the truth, once known and accurately presented, speaks for itself."

Here, at long last, is an author who does not underestimate his readers, which, in itself, is a new deal in historical writers and writing. Many accounts of this operation will be written, each emphasizing some phase of especial interest to the respective author. I predict that this account will occupy a top place in any military man's library, as it will in mine.—T. K. VINCENT.

Ploughshares into Swords: Josiah Gorgas and Confederate Ordnance. By Frank E. Vandiver. Austin: University of Texas Press. 349 pp. $5.

MR. VANDIVER has written both a biography of General Gorgas and the story of the Confederate Bureau of Ordnance. The latter, being the great work of Gorgas' life, is told at length and with competence.

The volume gives much information on Confederate weapons, but administrative detail far overshadows matériel, and the latter must be painstakingly picked out by the ordnance researcher.

The life of the remarkable man who, though Yankee-born, performed such prodigies as Chief of the Confederate Bureau of Ordnance in arming the forces of the South is most interestingly

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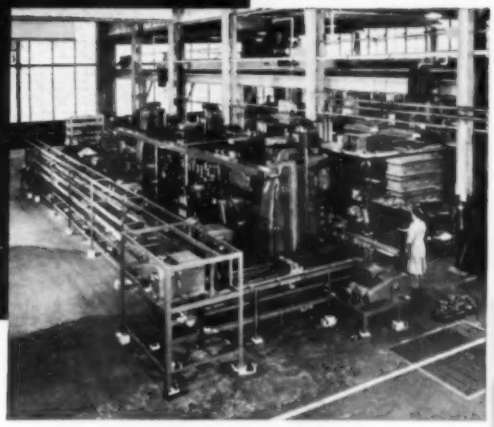

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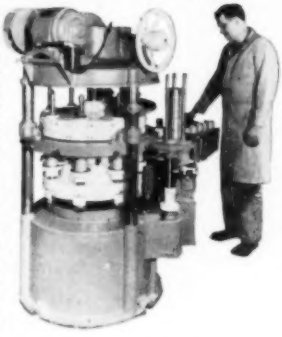
FEATURES of this new machine include a single adjustment for obtaining uniform seams consistently, moderate spindle speeds which eliminate "bounce" over side seams, and insure positive sealing. In addition, the design of the end feed makes it possible to take a wider variation in end sizes.



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Above, many progress-thru type machine tools employ fixtures which must be returned to the loading end of the machine, and this special Barnes conveyor is built to accomplish this purpose automatically and in time with the cycle of the machine. The machine itself, and all its hydraulic equipment and control circuits are also Barnes products. This 24 station machine performs 116 operations automatically on compressor frames.

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Left, a type of conveyor designed and built by Barnes for removing chips from machine tools, particularly those of the progress-thru type. Chips and cuttings are directed into the long trough and conveyor located in or under the machine. This heavy drag type conveyor delivers the chips to an elevator of similar chain design, from which they can fall into a waiting tote box. Variations of these units are adaptable to a wide range of applications.

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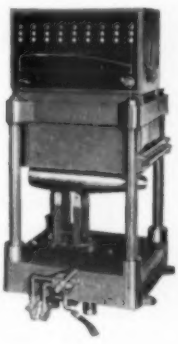

Free Additional Data

is available on all Barnes Ordnance equipment. Since it is impossible to give the complete scope of operation in this restricted space, we invite you to write for the complete Barnes Ordnance book. Ask for bulletin J-752.

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told. At the outbreak of the Civil War, Gorgas was commanding Frankford Arsenal. Never particularly a lover of southern life, he usually requested northern posts. Nor did Mrs. Gorgas intervene in his choice of allegiance. It was undoubtedly his deep convictions on states' rights and his hatred of the position of the "Black Republican" of that day which finally made him decide to cast his lot with the seceding Southern States.

Some little-known items of ordnance history, such as Grant's eagerness to trade his arms for captured weapons at Vicksburg as being "far superior to his own," highlight the story. Other ordnance data are disappointing, as the bare mention of the armored railroad gun at Savage's Station. This 32-pounder, the first of its kind in all history, might merit more! And there are a few ambiguities such as "5,000 Minié muskets" and "rifles and rifle muskets" pointing to a not-too-great familiarity with historical arms.

However, the main goal of the author—evaluation of Gorgas and his work as Chief of Confederate Ordnance—is very well done. Vandiver portrays his subject in thoroughly objective fashion as a man with faults and limitations who rose above them to perform an incredibly difficult task with almost incredible success.

Perhaps the greatest service performed by this volume is to place Confederate ordnance in its proper perspective in the study of the Civil War. Though somewhat short on the subject of matériel, it yet has considerable value in that field and answers some debatable points of Civil War history.—F. W. Foster Gleason.

Battery Duties. By Lieut. Col. Robert F. Cocklin and Maj. Mark M. Boatner, III. Washington: Combat Forces Press. 137 pp. $2.50 cloth, $1.50 paper.

THE companion volume to this excellent handbook, entitled "Company Duties," has been a "must" for all officers at the Ordnance Replacement Training Center. Its down-to-earth advice and its sensible and all-inclusive procedure guides for all personnel make it the "answer book" for the Army. As an old artilleryman, I appreciate the differences between company duties the battery duties, and the book "Battery Duties" takes care of those differences.

The flavor of the battery is captured in the instances cited, and the coverage of duties of officers, noncommissioned officers, and men makes it an authority in its field. The chapter on "battery commander" is a sound exposition of leadership at any level. I heartily indorse this book to all company and battery officers and men.—T. K. Vincent.

Flight in the Winter. By Jurgen Thorwald. New York: Pantheon Books, Inc. 318 pp. $3.75.

THE publisher describes this volume as a "terrifying book, one of the greatest dramas of contemporary history." It is all of that and more. To any man interested in military method and strategy in these agitated times, it is a "must" book. In all modern wars down to 1914 the military was little concerned with the movements of civilian populations.

There were refugee treks in World War I, but in World War II these treks grew to frightful proportions. Our army withdrew to the Elbe and refused to listen to the frantic appeals of the German generals who had been attempting for months to shield millions of women and children from the barbarity of the Red soldiers. If World War III comes we may experience more intimate contact with the conditions here described.

The author has given a remarkably graphic and attested account of the flight of millions of women and children from the violence, murder, and atrocious rape of the Communists, and of their vain efforts to surrender to the Americans. To this reviewer, the most terrifying feature brought out by the events

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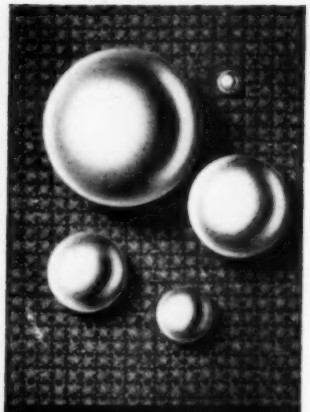

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described is the guilt which the American people must of necessity share in this wanton devastation and wastage of human life by our callous acceptance of the immoral and pagan doctrine of "unconditional surrender." It is estimated that the formula of unconditional surrender prolonged the war at least four months, cost the lives of untold millions of civilians, brought a devastation that is not yet repaired even with the expenditure of billions of American aid, and gave opportunity for the domination of Communism in Eastern Europe.

From the very first advance of the Russians into German, Hungarian, Rumanian, and Polish territory, the terrible aspects of the godless Bolshevik rapine were apparent. The hordes of the modern Genghis Khan came in American tanks, trucks, and jeeps and armed with American tommy guns.

Booty dumps had been established where the Red soldier was finally deprived of stolen watches and other loot, but it had been indoctrinated into him that the women of the conquered areas were his real prize. No female from 12 to 70 years of age escaped. German medical officers reported that in Konev's advance the scenes were so incredible that they would not be believed in later times. The savage cruelty with which the German soldiers and civilian men were butchered is even more incredible.

As the Russian pillage and rape advanced, it was aided by the American and British bombing of the cities behind the German lines and the bombing of the long files of civilians on the snow-covered roads. Breslau contained a million inhabitants, and Dresden held over 700,000 civilians. British bombers came in on the night of February 13th-14th, and whole boroughs were wiped out with incendiary bombs. Then waves of American planes followed on February 14th, and the exploding buildings caught the tens of thousands of people who had crowded in from the burning suburbs. At least 550,000 burned and mangled bodies lay in the streets and cellars of Breslau.

While the general slaughter and rapine were horrible, cases of individual mercy were numerous and notable. French and American prisoners of war fought to protect the German women and children. Montgomery permitted a technical change to be made in his orders so that the Germans who reached the lines of the Twenty-fifth British Army could surrender and pass. One American general, Gavin, could not endure the wanton waste, and permitted a hundred thousand to pass his lines. Other American commanders along the river blinked at the orders and allowed the pitiable women and children to cross, but some stood

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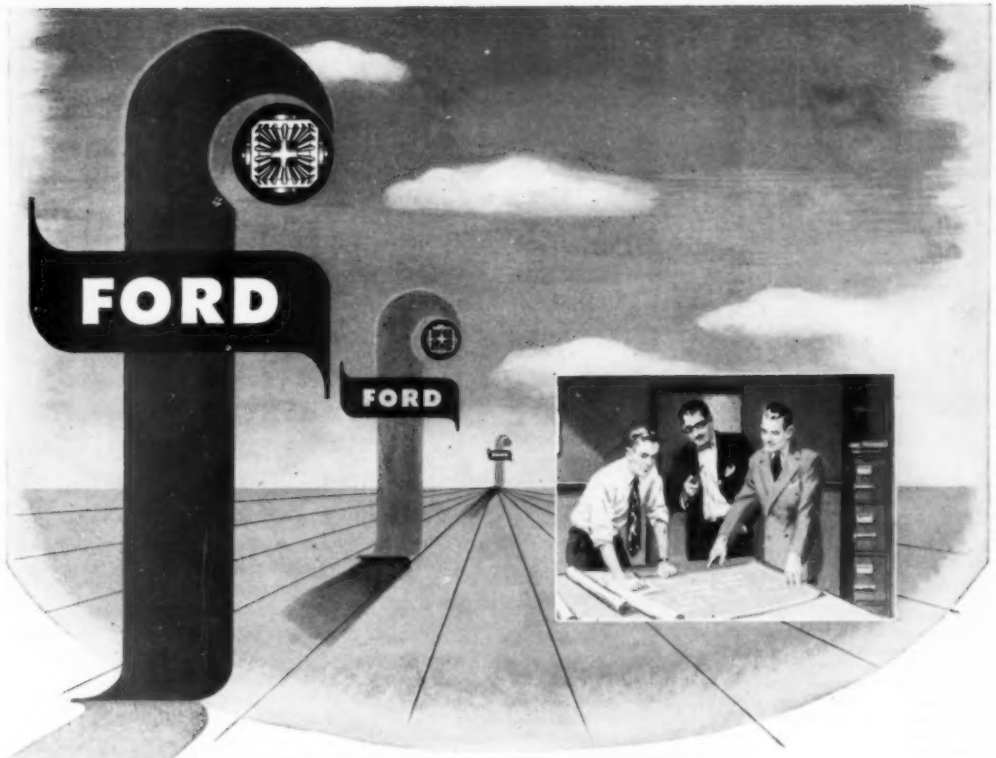

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Mathematics: Its Magic and Mastery. By Aaron Bakst. New York: D. Van Nostrand. 704 pp. $6.

THIS books reminds the reviewer of an occasion in the days of his youth when a friend, whom he remembers with gratitude, handed him a copy of A. N. Whitehead's "Introduction to Mathematics." This gift marked the beginning of real interest and liking for a subject in which instruction, prior to this event, had largely failed to touch the imagination. Mr. Bakst's "Mathematics, Its Magic and Mastery" is another such book.

If the title suggests that this work is largely concerned with the art of the magician and is primarily concerned with "trick" mathematics, it is definitely misleading. Granted a refreshing gaiety and the saving grace of humor, the author pursues his serious purpose of presenting the elements of mathematics in comprehensive and acceptable fashion.

The historical development of this vast field of human ingenuity is especially interesting, but lest the impression be created that the objective is wholly an intellectual exercise—valuable as this is—there may be gold for some in this particular hill.

It would ill become a conscientious reviewer if he did not discover at least one error per volume under consideration. In the chapter on ballistics, the German gun which fired on Paris in 1918 is referred to as "Big Bertha." The original Big Bertha was a 42-cm. howitzer employed by the Germans to batter the forts at Liége and Namur in 1914. However, the author may be forgiven this misnomer since newspaper correspondents were originally responsible.

To avoid a conclusion on a discouraging note, there is complete agreement with the publisher that "for the general reader, the student, and the teacher, there can be few books more likely to become a treasured part of the permanent bookshelf."—ARTHUR F. MACCONOCHIE.

The Siberian Fiasco. By Clarence A. Manning. New York: Library Publishers. 210 pp. $3.75.

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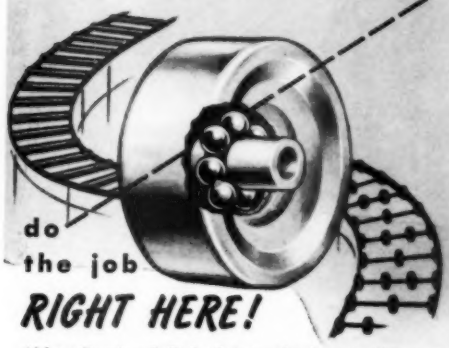

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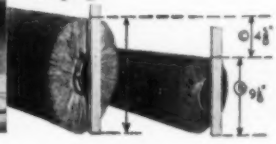

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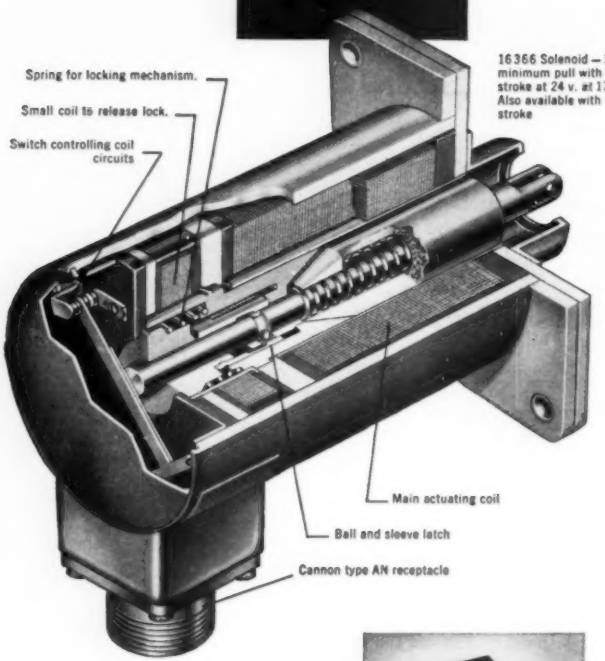
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Book Reviews

pert on Slavic affairs, could not have been published at a more opportune time. The same blind leap into the far corners of the world, the same lack of coöperation between military and political leaders, the same conflict of the do-gooder and the rational American is still with us—only today the potential of disaster is increased.

The story of our Siberian misadventure is begun with a really good summary of the Socialist Revolution and its causes. The semimystical, wholly childish fervor of the Russian peasant, without which Slavic happenings are incomprehensible, is shown. The Czarist bureaucracy, of which our own is but a shadow, is evaluated. Communist "boring from within," so familiar to us today, is described.

After a short description of the strange, vast land of Siberia, with its cultural and historical background, Manning recounts the Red treachery which turned the Czechoslovak legions into antibolsheviks and paved the way for intervention. The sending of the Railroad Commission of a few hundred Americans to Vladivostok was the entering wedge. Masaryk appealed for our aid in getting the Czechs home, President Wilson declared that we would never interfere in Russia's affairs, and the sorry, ill-planned farce was on.

On August 3, 1918, intervention was announced. The seventeen weary months which intervened between that date and the finally announced withdrawal of American troops (January 16, 1920) are recorded in all their hopelessness. The author has done a good job of pointing up the fine purposes and high hopes of the start; the half-baked plans and promises, so suggestive of the "Point Four" program; the bitter wrangling with allies; the disappointing (but inevitable) lack of appreciation by the beneficiaries; the stark and barren chaos of the end.

"Siberian Fiasco" is not easy reading. Were it not on a subject of such vital parallel to the Korean situation, it might even be dull. But the thoughtful reader must surely agree with Manning's conclusions: that thorough study and analysis of this venture of thirty years ago, if put into practice, would have prevented our ghastly losses in Asia of the past six years and the bloody stalemate of Korea. —F. W. Foster Gleason.

Alcoa—An American Enterprise. By Charles C. Carr. New York: Rinehart & Company. 292 pp. $3.50.

THIS is an inspiring and detailed account of the beginnings, growth, and present position of the Aluminum Company of America. Here are recorded the triumphs—and the defeats—during the first sixty-two years of existence of one

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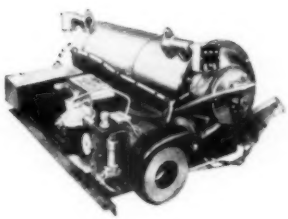

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of America's greatest commercial enterprises. Mr. Carr had available the complete files of the company and also has checked the data with many qualified company officials. Having served for many years as director of public relations for Alcoa, Mr. Carr knew intimately the highlights of the record. He has described with accuracy and understanding the steps that have led from the small beginnings to the gigantic position attained by Alcoa in its contributions to the advancement of our country in peace and in war.

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Pension and Retirement Rights. By Elmer J. Smith. Arlington, Va.: Elmer J. Smith. 96 pp. $1.

A CLEAR and complete exposition of the myriad pension and retirement laws and regulations, this book is compiled in readable form and classified under Veteran's, Reserve, National Guard, Regular, and Survivors' benefits. Every veteran's organization and personnel officer should have a reference copy, and all individuals concerned, particularly survivors, who are interested in their rights under the involved regulations we have, may find missing income authorized here. A very well prepared document.—THOMAS K. VINCENT.

AMERICAN ORDNANCE ASSOCIATION

Book of the Month for July

SAMUEL COLT
A Man and an Epoch

BY MARTIN RYWELL

"Samuel Colt" is three books in one—a biography of the inventor and arms manufacturer, an historical sketch of his times, and a practical guide to Colt firearms.

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For the firearms enthusiast and collector the real meat of the book is in the 34-page section devoted to the Colt firearm itself—chronology, description, and present approximate value. Each piece is illustrated and minutely described, and the prices given are accurate and realistic. Retail, $3.00.

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UNDER THE SEA WIND

BY RACHEL CARSON

Rachel Carson, whose "The Sea Around Us" delighted so many readers, is also the author of "Under the Sea Wind," which has in it the same combination of magnificent writing and scientific fact. In this book we are introduced to the creatures who live above and beneath our coastal waters. Retail, $3.50. To members, $3.15.

THE NEW YORK ORDNANCE DISTRICT IN WORLD WAR II

BY COL. CHESTER MUELLER

This study of America's decentralized procurement system is of added significance today. Retail, $5.00. To members, $3.00.

I WAS STALIN'S PRISONER

BY ROBERT A. VOGELER

Robert A. Vogeler is the communications executive who was imprisoned for 17 months in Hungary. This is his dramatic story of what happened to him—his imprisonment, the first and second inquisitions, why he confessed, the rehearsal for his trial, his day in court, how he served his sentence, and the terms of his ransom. Retail, $3.75. To members, $3.37.

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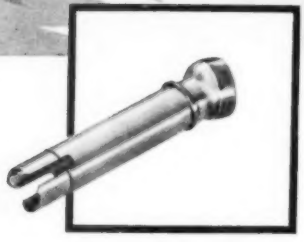

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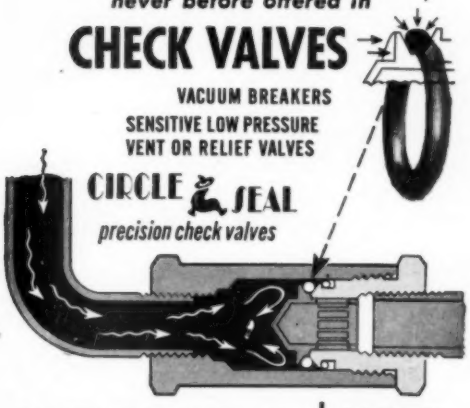

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Type I Medium	NC-710
Type I Firm	NC-711
MIL-T-6841	(DK-153 (RK-304S
Type II Soft	DC-167
Type II Medium	DC-100
Type II Firm	DC-113
MIL-G-6747	DK-149

Write for samples and 24-page gasket design manual.

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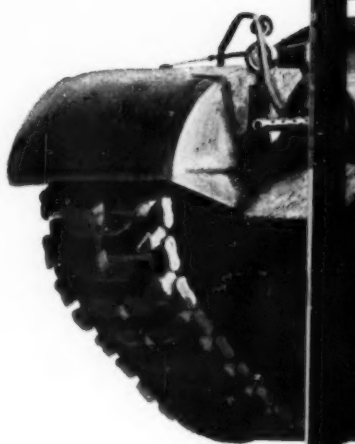

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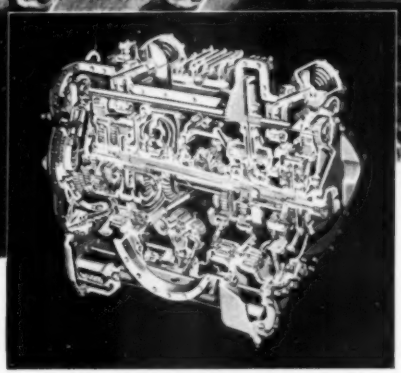

Illustrated is General Patton tank with cutaway view of Model CD-850 Allison Torqmatic Transmission

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Specification Corrosion Preventive Compounds for Government Contractors

Specification Number	Trade Name
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MIL-C-972, Grade II (Superseding 52-C-18 Grade II)	Klad Kote 122
MIL-C-6708, Type I (Superseding AN-C-52b Type I)	Klad Kote 102
MIL-C-6708, Type II (Superseding AN-C-52b Type II)	Klad Kote 252
AN-C-124a, Type I	Klad Kote 124
AN-C-124a, Type II	Klad Kote 224
AXS-673, Rev. 2	Klad Kote 103
AXS-1759, Grade I	Klad Kote 171
AXS-1759, Grade II	Klad Kote 172
AAF 14156, Amend. 1	Klad Kote 356
USA 2-122	Klad Kote 322
USA 2-121	Klad Kote 221
AN-VV-C-576b, Type I	Klad Kote 376
AN-VV-C-576b, Type II	Klad Kote 378
Light Bodied Slushing Compound (Excellent Water Displacing and Surface Active Qualities)	Klad Kote 365

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Anti-Seize Compounds: MIL-C-5544 – JAN-A-669.
Aircraft Cleaning Compounds: Army Air Force AAF 20015-E – Navy Aero C-147.
Non-Inflammable Hydraulic Fluid: Navy BuAer MIL-F-7083
Protective Coating: Army Ordnance AXS-1756 – Navy Ordnance 52-C-44.
Paint Remover: Navy BuAer 52-R-15, Amend. I.
Carbon Removal Compound: Army Air Force AAF X20043-A.

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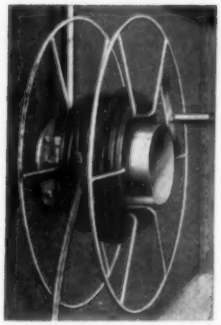

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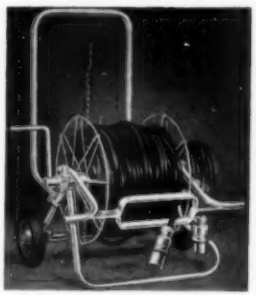

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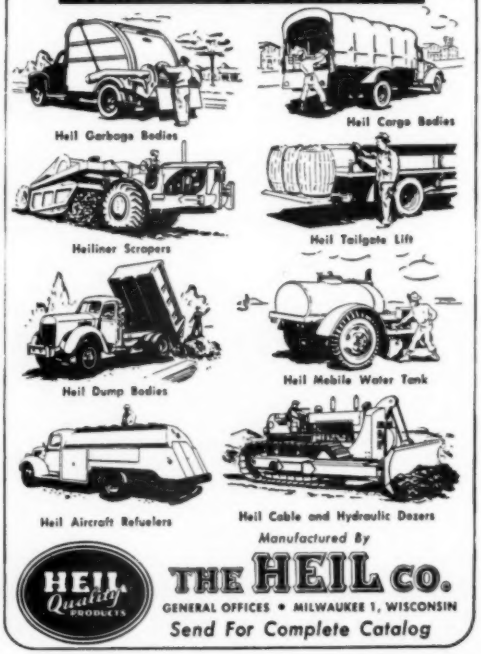

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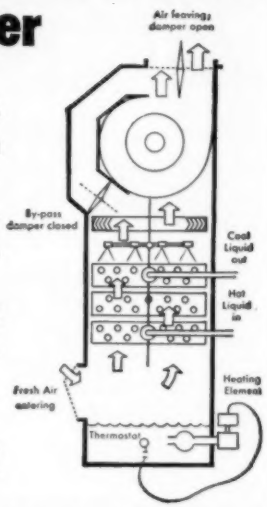

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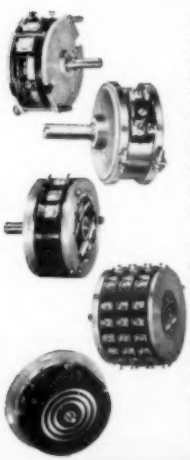

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Angles—leg in	$\frac{1}{16}\times\frac{1}{16}$	$1\frac{1}{16}\times1\frac{1}{16}$
Minimum diameter	30	48
Smallest Angle—leg out	$\frac{1}{16}\times\frac{1}{16}$	$\frac{1}{16}\times\frac{1}{16}$
Minimum diameter	4	6
Smallest Angle—leg in	$\frac{1}{16}\times\frac{1}{16}$	$\frac{1}{16}\times\frac{1}{16}$
Minimum diameter	6	7
Flats on edge	$\frac{1}{16}\times\frac{3}{16}$	$1\times\frac{1}{4}$
Minimum diameter	6	7
Flats on flat	$2\times\frac{3}{16}$	$2\times\frac{1}{4}$
Minimum diameter	5	6
Rounds and squares	$\frac{1}{4}$	$\frac{1}{4}-\frac{15}{16}$
Minimum diameter	5	6
Copper tubes—13 gauge	$\frac{3}{4}$	1
Copper tubes—16 gauge	1	$1\frac{1}{4}$
Standard st. pipe	$\frac{1}{4}$	$\frac{3}{4}$
Minimum diameter	5	6
Diameter angle rolls	$2\frac{1}{4}$	$5\frac{1}{2}$
R.P.M. rolls	72.5	48
Feet per minute	75	60
Size motor—H.P.	$1\frac{1}{2}$	2
Speed motor	1800	1200
Diameter upper shaft	$1\frac{15}{16}$	3
Diameter lower shafts	$1\frac{15}{16}$	3
Gear Ratio	24	63
Length	2'-0"	3'-10"
Width	2'-0"	2'-6"
Height	1'-6"	2'-0"
Weight, lbs.	575	875
Code	AJLIM	AHPUP

The capacity table (left) shows the variety of small-diameter bending jobs which can be performed at production speeds on "Buffalo" Pinch-Type Bending Rolls. All rolls are adjusted by crank, and may be set up or changed in seconds. Bars, pipe or copper tubing can be rolled in continuous spirals without distortion. Bars may be bent in spirals for high production of perfect rings without wasting any material. If you bend metal, you do it at a fraction of the cost of any other method by "Buffalo" Bending Rolls. Bulletin 352-C has data on all sizes, from the small pinch type to the No. 4 for the heaviest bending. WRITE FOR YOUR COPY!

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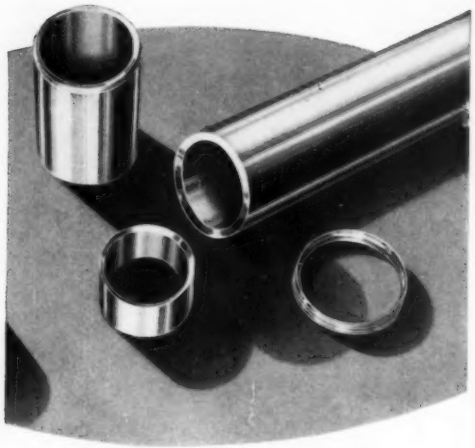

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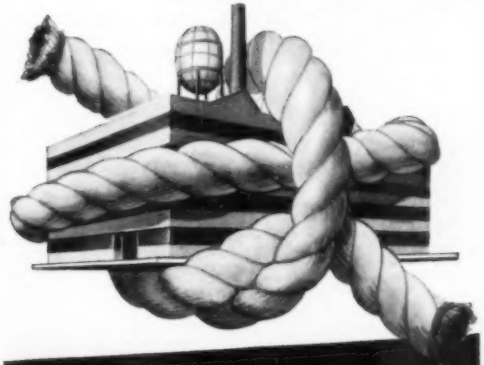

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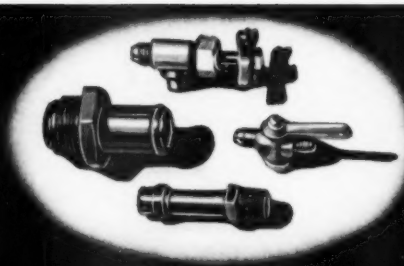

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INDEX TO ORDNANCE, VOLUME XXXVI

● The Index to Volume XXXVI of ORDNANCE, with title page for binding, is now available. It will be sent free of charge upon request to the Editorial Offices at the address below. It covers subjects in the following 1951 and 1952 issues: July-August (No. 187), September-October (No. 188), November-December (No. 189), January-February (No. 190), March-April (No. 191), and May-June (No. 192). It is arranged alphabetically by subject and author.

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ARMAMENT TECHNOLOGY

This section of ORDNANCE contains articles of a detailed and technical nature on ordnance research, development, manufacture, field use, and related subjects.

Air Force Armament Center

Developing Weapons Systems for Modern Aërial Combat

Brig. Gen. E. P. Mechling

Commanding General, Air Force Armament Center, Eglin Air Force Base, Fla.

A WEAPONS system is composed of many individual components of which the armament system is a most important factor, for as Lord Trenchard, former British Air Marshal, has so aptly stated, "without armament, there is no Air Force."

Modern armament systems have developed to such an extent that a facility devoted primarily to the development and tests of those systems was deemed essential. Consequently, in March 1949 the Chief of Staff, United States Air Force, directed the establishment of an air proving ground.

After considerable study the site for the location of this activity was determined to be Eglin Air Force Base, Fla. The greatest asset of the Eglin location is the amount of land area available for the conduct of the assigned mission—some 800 square miles—and the further availability of some 6,400 square miles of water ranges.

Facilities Determined

Intensive planning was instituted immediately to determine specific facilities required to test the highly technical equipment coming from the development agencies. Not the least of the actions required at the time was the acquisition of funds for the purpose of constructing the required facilities. The Congress approved the construction of the center, and to date funds in the amount of approximately $14 million have been appropriated.

An Ad Hoc committee of the Scientific Advisory Board, the so-called Hutcheson Committee, recommended the assignment of the Armament Test Division to the Air Research and Development Command. Such transfer was accomplished on December 1, 1951.

The organization has been designated the Air Force Armament Center with the following mission: "to accomplish tests of matériel in the armament field and research and development to such tests; to provide support of the Air Research and Development Command; and, to provide facilities for contractors and for other governmental agencies."

Three Phases

The build-up of the Air Force Armament Center was divided into three phases, Phase I consisting of those interim facilities required to permit an initial operation. This phase consisted of two administrative buildings planned for conversion to barracks at some future date, a hangar, and a warehouse to accommodate the incoming equipment. Phase I has been completed.

Phase II is considered the "heart" of the Air Force Armament Center and consists of those major technical facilities and ranges required in the conduct of an armament development test. An Armament Engineering Building has been designed for the purpose of testing Air Force armament systems and armament matériel in the development stage as well as the design and engineering of instrumentation required in the conduct of these tests. It is an accepted fact that, in most instances,

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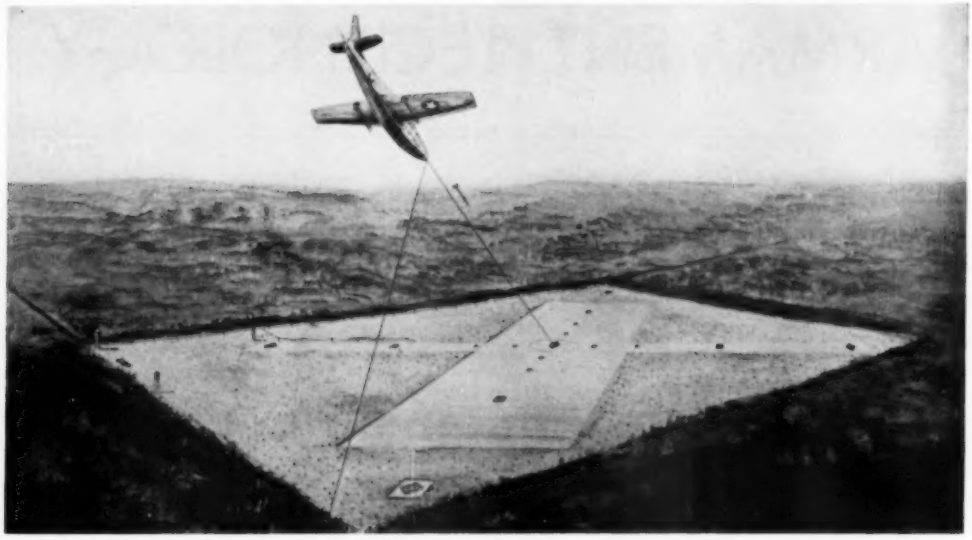


Air-to-ground rocketry range used in evaluation of aircraft fire-control systems at the Armament Center.

instrumentation required for the testing of an item is definitely more complex than the item being tested. Limited shop facilities will be available for modifications and mock-ups.

Armament Installations

An Armament Installations Building has been designed primarily for the purpose of accommodating the installation and accomplishing extensive armament modification and the maintenance of armament equipments on all types of aircraft.

As an example of the requirement of such a facility, the installation of a stellar inertial bombing system must be undertaken where the aircraft is immobilized to the extent that it would not suffer movement of more than one degree of arc during the entire operation.

The design of this structure is complete and is currently being reviewed by the Engineers. It will be completed by about March 1953.

A Heavy Systems Building will provide facilities for the testing of prototypes of all kinds of armament matériel, particularly of large and heavy assemblies which cannot be accommodated in the Armament Engineering Building.

The operations center will be housed on the second floor of this structure and will include range control, complete range communications systems, and data-reduction equipment. It will also provide facilities for shipping, receiving, servicing, and storing those special items required for the Air Force Armament Center.

An enlargement of the ammunition area, which is currently forty per cent complete, is required to accommodate the live ammunition and bombs required in the conduct of the Air Force Armament Center mission.

Our highest priority ranges at this time are the precision bombing range and the air-to-ground rocketry range. The precision bombing range is intended for use in the conduct of precision testing of bombing systems, new bombs, and other missiles. The basic function is the determination of initial conditions at release points, trajectories, performance during fall, air bursts, ground impacts, time of fall, and terminal velocities at all altitudes and speeds. Ground clearance has been accomplished and theodolite towers are in the process of construction.

Theodolites Available

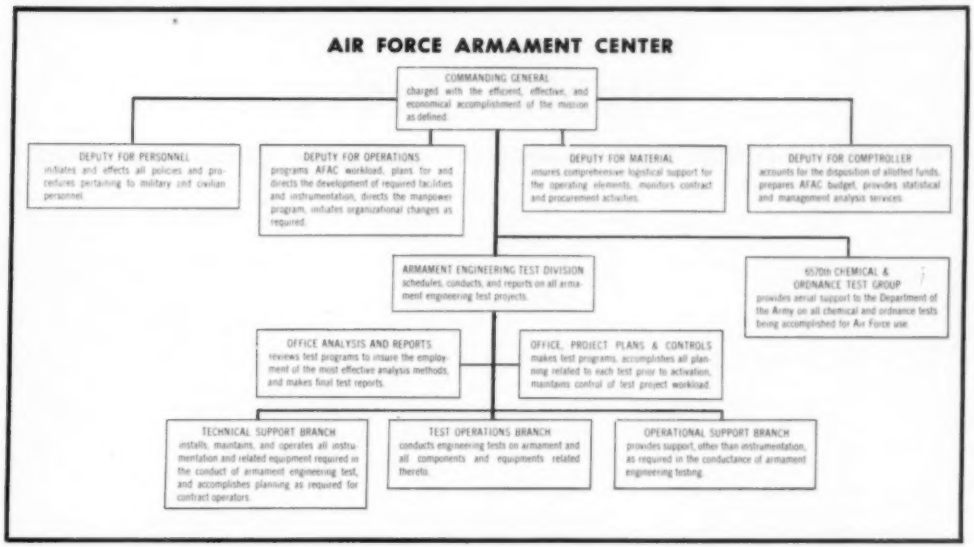
Six modified Askania theodolites are available, complete with time standard, for installation when the towers are completed. These theodolites will be used primarily to determine bomb positions in space. Superimposed on the precision range is the so-called B-Line System, which is essentially an air range to determine the location of an aircraft in space and to determine a constant bomb-release point.

Bombing System Tests

At the time the precision range is completed and the B-Line System is installed and operating, the Air Force Armament Center will have an initial capability of performing tests on any bombing system to include the bomb ballistic functions currently being performed by the Army Ordnance Corps at Muroc.

The primary purpose of the air-to-ground rocketry range is the evaluation of aircraft fire-control systems, including those designed for gunnery, rocketry, skip bombing or dive bombing, as well as the determination of exterior rocket ballistics when rockets are fired from air to ground at varying conditions of dive, speed, and range.

Phase III build-up covers the final fully automatic data-processing system utilizing the most modern calculating equipment. It contains those improvements to the ranges just described to permit an all-weather capability by the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charged with the efficient, effective, and economical accomplishment of the mission as defined.
DEPUTY FOR PERSONNEL
initiates and effects all policies and procedures pertaining to military and civilian personnel.
DEPUTY FOR OPERATIONS
programs AFAC workload, plans for and directs the development of required facilities and instrumentation, directs the manpower program, initiates organizational changes as required.
DEPUTY FOR MATERIAL
insures comprehensive logistical support for the operating elements, monitors contract and procurement activities.
DEPUTY FOR COMPTROLLER
accounts for the disposition of allotted funds, prepares AFAC budget, provides statistical and management analysis services.
ARMAMENT ENGINEERING TEST DIVISION
schedules, conducts, and reports on all armament engineering test projects.
6570th CHEMICAL & ORDNANCE TEST GROUP
provides aerial support to the Department of the Army on all chemical and ordnance tests being accomplished for Air Force use.
OFFICE ANALYSIS AND REPORTS
reviews test programs to insure the employment of the most effective analysis methods, and makes final test reports.
OFFICE, PROJECT PLANS & CONTROLS
makes test programs, accomplishes all planning related to each test prior to activation, maintains control of test project workload.
TECHNICAL SUPPORT BRANCH
installs, maintains, and operates all instrumentation and related equipment required in the conduct of armament engineering test, and accomplishes planning as required for contract operators.
TEST OPERATIONS BRANCH
conducts engineering tests on armament and all components and equipments related thereto.
OPERATIONAL SUPPORT BRANCH
provides support, other than instrumentation, as required in the conductance of armament engineering testing.

Organization chart showing the chain of command at the Air Force Armament Center.

replacement of the intially planned optical systems with electronic systems which are currently under development, as well as additional ranges to permit complete coverage for testing in the total armament field. In other words, test results will be known while the test is in progress.

Standards Building

A Standards Building is required to provide separate housing for the physical standards used to calibrate instrumentation systems and test equipments. The housing provided for these physical standards must meet rigid specifications of temperature and humidity control as well as be dust-free.

These factors, when added to the maximum vibration allowance on many standards, make it uneconomical to attempt to construct sufficiently isolated rooms in the Armament Engineering Building for the housing of such standards.

Scoresby Building

A Scoresby Building is required for the dynamic ground testing of heavy stabilized aircraft systems, such as gun turrets, bombing radar turrets, and stellar inertial bombing and navigational systems. This structure houses a 3,000-pound load rate table, known as a Scoresby platform, which has been developed by the Navy and which will be used in the engineering development testing of these systems.

Augmentation of the precision bombing range has already been touched on. Additional instrumentation is planned for the current pattern bombing range to permit train and salvo operations.

Rocket Ballistics Range

The rocket ballistics range will be used to conduct tests of rocket trajectories and interior ballistics to determine the effect on aircraft weapons systems when the rockets are fired in maximum and minimum temperatures. Further, aircraft armament, armament systems, rockets, and rocket launchers in all stages of development mounted in aircraft can here be tested statically for engineering performance and evaluation.

The range will also serve as a location where damage potential evaluation may be accomplished. The facilities of this range will include a preacceleration launching ramp, camera stations, temperature-conditioning buildings, rocket ballistics, shelter, and reference markers.

A moving target range is planned for installation on the air-to-ground rocketry range. This will consist essentially of a standard-gauge track capable of accommodating sleds or wheeled vehicles up to speeds of sixty miles an hour.

An air-to-air rocketry and gunnery range is vitally required by the Air Force. However the existence of a suitable range of this type is dependent upon the development of suitable airborne as well as ground instrumentation to enable a determination of what happens at extremely high altitudes. Such instruments are under development to accommodate this requirement.

Various developments under way are the firing-error indicator and azuza systems. All facilities discussed above are currently being designed and should be ready for operation in the not-too-distant future.

The Air Force Armament Center has requested permission for a contract-type operation, which is justified by the acute shortage of technically qualified Civil Service personnel. Approval for such operation has been received at the Armament Center.

Capability for Tests

At the time the facilities discussed here are constructed and operating, the Air Force, for the first time, will have a real capability for the conduct of true engineering development tests on armament systems.

Titanium Today

New Light Metal Was Laboratory Curiosity Three Years Ago

by

R. S. Radcliffe

Pigments Department, E. I. du Pont de Nemours & Company, Wilmington, Del.

Two titanium alloys have been announced which, when judged by strength-weight ratio, can be considered the strongest metallic materials of construction yet produced.

FEW technological advances have received more attention by the public press than the transition of titanium in the past three years from a laboratory curiosity to a metal of construction. In September 1948 the Du Pont Company announced the first commercial production and sale of the metal for evaluation as a construction material. This first commercial production came from a pilot unit plant with a nominal daily capacity of one hundred pounds.

Rate of Production

The U. S. Bureau of Mines has estimated the production of titanium metal in 1951 as 700 tons and the rate of production at the end of 1951 as 1,400 tons annually. The Bureau also disclosed that governmental agencies are negotiating with industry to expand present facilities to assure a national production in the neighborhood of 7,000 tons annually.

In March 1951 the Du Pont Company put into operation the first commercial-scale plant. This plant is now producing metal at the rate of more than 1½ tons a day and is expected to be producing 2½ tons a day by the end of 1952.

In the present era of air travel and air warfare it is not surprising that the armed forces in particular and the public in general should be interested in titanium. The metal in the commercially pure state can be compared favorably in strength to many steels yet weighs only fifty-six per cent as much.

Corrosion Resistant

While not a high-temperature metal, it can operate at higher temperatures than the present alloys of aluminum and magnesium. In addition, titanium is highly resistant to corrosion, particularly in respect to chlorine, chlorides, and marine atmospheres.

As air speeds increase, aircraft structures must be increased in strength and must operate at higher temperatures than formerly, yet the structures must remain light in weight. Under these circumstances the importance of the ratio of strength to weight becomes of basic importance in the decision as to which material of construction shall be used.

Commercially pure titanium and the pioneer alloys of titanium can be compared favorably in strength-weight ratio to the present alloys of iron, aluminum, and magnesium. In fact, two titanium alloys have been announced which, when judged by strength-weight ratio, can be considered the strongest metallic materials of construction yet produced.

To the military, a major factor of logistics is weight. It is obvious that if titanium can supply strength at a reduced weight, its value to the armed forces for equipment is tremendous.

Titanium is of especial strategic importance because there are adequate ore supplies on the North American Continent to support a large industry. In fact, titanium is the ninth most abundant element occurring in the earth's crust.

In addition, there is a full-scale American industry based on titanium chemistry which has to date concentrated its efforts on the production of titanium dioxide, a white pigment, with annual sales of $125,000,000. This industry has developed "know-how" and ore supplies which can be used to forward the progress of titanium metal.

It is to the credit of the U. S. Bureau of Mines that the importance of titanium was appreciated and action taken to investigate means of producing the metal, culminating in the establishment of a pilot unit for its production.

Isolated in 1791

Titanium was first isolated as an element by Gregor in 1791, but it was not until 1910 that metal of high purity was produced. In the interval, many workers investigated methods of producing titanium, but only two processes appeared to have economic possibilities

Table 1, below, shows nominal properties of commercially pure titanium metal at normal room temperature in the annealed state (4, 21, 22).

Producer	Mallory-Sharon Titanium Corp.		Rem-Cru Titanium, Inc.		Titanium Metals Corp. of America	
Identification	L-2859	L-2749	RC-55	RC-70	Ti-75A	Ti-100A
Ultimate tensile strength (psi)	75,000	90,000–105,000	65,000–75,000	80,000–90,000	70,000–89,000	100,000
Yield strength (psi)	50,000	80,000–95,000	55,000–65,000	70,000–80,000	45,000–55,000	75,000
Elongation (%)	20–30	15–20	25	20	20–30	18–20

Producer	Mallory-Sharon Titanium Corp.	Rem-Cru Titanium, Inc.		Titanium Metals Corp. of America		
Identification	L-2748	RC-130A	RC-130B	Ti-125A	Ti-150A	Ti-175A
Nominal chemical analysis	3% Al, 5% Cr, 0.4–0.7% C	7% Mn	4% Mn, 4% Al	1.8% Cr 0.9% Fe	2.7% Cr 1.3% Fe	3.0% Cr 1.5% Fe
Ultimate tensile strength (psi)	165,000	150,000	145,000	125,000	150,000	175,000
Yield strength (psi)	153,000	140,000	135,000	80,000	130,000	160,000
Elongation (%)	10	12–15	15–20	18–20	12–20	10–12

Table 2, above, shows the nominal properties of titanium-base alloys at room temperature (4, 21, 22). Table 3, below, shows the relative strength-weight ratios of titanium and its alloys versus aluminum alloys and stainless steels.

Alloy	*Aluminum*		*Steel*	*Titanium*					
Identification type	75-ST	24-ST	302	RC-55	RC-70	Ti-125A	RC-130A	Ti-175A	L-2748
Ratio: Ult. Tensile (psi) / Density (lbs./in.^{3}) $\times 10^{-2}$	792	672	306	469	563	781	937	1,090	1,030
Ratio: Yield Strength (psi) / Density (lbs./in.^{3}) $\times 10^{-2}$	713	406	131	406	500	500	875	1,000	956

for commercial production of ductile metal.

The first of these was based on the thermal decomposition of titanium iodide, and the second method was based on the reaction of titanium tetrachloride and molten alkali or alkaline earth metals. Since 1948 two electrolytic processes have been announced, but to date these processes have been confined to laboratory production.

The problem which faced chemists, engineers, and metallurgists in the 150 years from the time the element was discovered until it was put into commercial production involved the chemical nature of titanium. Titanium reacts or forms alloys with practically all known elements except the inert gases such as argon and helium.

Its compounds with other elements, once formed, are very difficult to break down. It begins to absorb oxygen and nitrogen and other atmospheric gases at about 1,300 degrees Fahrenheit to form compounds which tend to give a brittle and unworkable impure metal.

Violent Reaction

At its melting point this reaction is violent, and in addition it reacts with all refractories and takes into solution metals or alloys that might hold it.

The process using the reaction of titanium tetrachloride with molten magnesium accounts for the major amount of commercial metal now being made. The iodide process is being operated to produce small quantities of high-purity metal, but has not as yet been scaled up to commercial operating size.

A Sponge Mass

The product obtained from the magnesium reduction of titanium tetrachloride is a sponge mass with a metallic appearance and contains a minimum of 99.3 per cent titanium. In this form it has little value as a material of construction. It must be further consolidated before such forms as rod, sheet, and bar can be produced.

At the time of the announcement of the first commercial production of titanium, only laboratory methods for consolidation had been worked out. The Battelle Memorial Institute had developed a method of melting which employed an electric arc as the source of heat, a water-cooled copper crucible, and an inert gas atmosphere such as argon or helium. The Bureau of Mines had pursued actively a development program of consolidation through powder metallurgy.

Beginning in late 1948 the Du Pont Company pioneered in the development of furnaces to melt titanium. Two furnaces of commercial size were developed by this program; the first employed a graphite crucible and induction heating; the second employed an electric arc, water-cooled copper crucible, and an inert gas atmosphere.

The induction furnace proved to be the simpler to operate, but, unfortunately, titanium reacted at its melting point with graphitic carbon. The reaction, however, proved to be controllable, so that metal containing 0.4 to 1 per cent carbon was obtained. The carbon-containing metal, while ductile and suitable for some uses, was not completely satisfactory because of poorer formability and low impact strength.

Arc Furnace Method

The arc furnace produced metal of high purity using either a carbon or tungsten electrode. Metal from this furnace was more formable and of higher impact strength than that produced by the induction furnace. In addition, the arc furnace was found to be amenable to continuous casting of ingots.

These early studies have led to the development of induction furnaces capable of casting ingots in sizes up to 650 pounds. The arc furnace has been scaled up so that at present ingots in excess of 1,000 pounds are being cast regularly.

The establishment of sizable pieces of consolidated metal allowed studies of techniques for the working of titanium. Early studies on methods of forging and rolling indicated that titanium could be forged between 1,450 and 1,850 degrees Fahrenheit and could be hot-rolled at furnace temperatures of 1,350 to 1,500 degrees Fahrenheit. These operations, including the heating of the metal, could be carried out under normal atmospheric conditions.

Satisfactory Annealing

Annealing could be accomplished satisfactorily at 1,300 degrees Fahrenheit in air except where very thin sheet was involved, in which case vacuum or inert-gas annealing was required. Sponge titanium metal which had been consolidated by either melting system could be cold-reduced 30 to 50 per cent. The metal was strengthened by such reduction.

From these early results, despite titanium's great chemical activity, it appeared that it could be heated, forged, rolled, and annealed in equipment normally used to produce stainless-steel fabricated forms with no unusual precautions.

This work was largely completed by late 1950, and by early 1951 at least four concerns had commercial-size furnaces for melting titanium in operation and were producing forgings and representative semifabricated forms such as sheet, rod, and bar.

Research Program

In the period during which the melting furnaces and methods of fabricating titanium were in progress, a parallel research program of even greater size was being carried out to study alloys of titanium, to strengthen the metal, and to widen its field of application, particularly by raising its strength-weight ratio and reducing its sensitivity to high temperature and gaseous attack. These research programs received governmental, industrial, and academic support.

As a result of this work there are available on the market today in various semifabricated forms two general classes of commercially pure titanium metal and six alloys, as shown in Tables 1 and 2. No doubt other alloys are ready for commercial evaluation which have not as yet been announced publicly.

Table 3 shows the comparative strength-weight relations between these alloys and representative aluminum alloys and stainless steels. For full information concerning further properties of these alloys reference should be made directly to their suppliers.

With semifabricated forms of commercially pure titanium and titanium alloys available, the next step in the development became the study of means for manufacturing production items such as airframe components, jet-engine parts, chemical filters, and the like, from these forms.

Studies Made

The development of titanium metal as a material of construction is now in this stage. Studies of grinding, forming, and welding are being undertaken by industrial and governmental research and development groups. To date the entire production of titanium is being used for testing and the development of experimental prototypes.

No finished item which consumes titanium is in continuous production, though many items are very close to being placed in this category. The potential uses for titanium have been well defined by the development programs which have been completed.

O. A. Wheelon, in his report before an SAE National Aëronautic Meeting sums up very aptly the possibilities of titanium for airframes.

"Today's high-speed airplane or missile presents serious problems from a material standpoint. Aërodynamic heating may be critical, and, in addition, a significant portion of the structure is exposed to higher temperatures with jet and rocket engines. . .

"In the 300 to 800 degrees Fahrenheit range, titanium and its alloys have considerable strength-weight advantages over the stainless steels which have been previously used in this temperature range. Because of its high melting point, titanium also makes a suitable fire shield up to 2,000 degrees Fahrenheit since it will not burn through even though it may ultimately have to be replaced. . .

"A preliminary analysis showed that a limited application of commercially pure titanium would make possible a saving of approximately five per cent of the structural weight. Despite its high cost of $20 a pound, this use represented the most economical method for saving this critical weight, provided parts could be fabricated with reasonable means."

Use in Airframes

Consequently titanium is being considered by the airframe industry for parts of present and future planes, ranging from nuts, bolts, and other fasteners up to large sections requiring greater strength than aluminum and lighter weight than steel.

Research on turbojet power units for aircraft shows the need of a new construction metal, particularly for the compressor end of the motor, where operating temperatures above 400 degrees Fahrenheit are being encountered in new designs. The use of titanium in place of steels in such engines affords a much higher development of power than is indicated by the amount of weight saved.

The unusual corrosion resistance of titanium in sea water immediately suggests its use in construction of naval units. The U. S. Naval Experimental Station has pointed out that its tests show titanium to be unusual in respect to its endurance limit, corrosion fatigue in sea water, crevice corrosion, and seawater cavitation.

Price Is High

The Experimental Station also points out that the high price—$5 a pound in sponge form—will confine its use to small parts such as exhaust mufflers, metering equipment, condenser and heat-exchanger tubes, antenna wires, and trim for salt-water valves.

Col. Benjamin S. Mesick has stated very aptly the importance of titanium for ordnance use (see ORDNANCE, January-February, 1951, p. 351). The value of light weight with strength to increase mobility and firepower, and decrease the logistics load is obvious. Research carried out by the Ordnance Corps of the Army has indicated that "alloys of titanium are now available which have a yield strength on a comparable weight basis of at least 1½ times that of large production steel alloys in the fully heat treated condition. The Charpy (impact) values of titanium alloys are on the high side of the range of the metals considered (this indicates toughness to a fairly high degree), and the elongation values of titanium alloys are moderately good."

Titanium will also undoubtedly find use in the fabrication of chemical equipment. Titanium today in its commercially pure state stands high in corrosion resistance in comparison with materials now in use. Its corrosion resistance to chlorine and the chlorides is unusual. In addition, studies are under way to produce alloys which are more resistant to the mineral acids than the commercially pure metal.

Important Problem

Perhaps the most important problem facing engineers today is the development of materials of construction, particularly alloys, which can withstand the high temperatures which accompany newer engine designs. Already there are several alloys on the market which use titanium in relatively small amounts—three per cent and under—which may be improved by the use of high-purity titanium metal. It can also be envisioned that alloys may be forthcoming using titanium to replace sizable quantities of metals which are in critically short supply.

International

Old antiaircraft gun during night firing practice at Fort Tilden, N. Y.

Postmortem on Flak

Early Recollections on the Development Of Antiaircraft Guns and Fire Control

Col. Charles G. Mettler

OUR Korean losses from antiaircraft fire have indicated such remarkable increases in effectiveness through the use of new instruments and methods that even the Communist reserves with little training seem to become really serious menaces to our air attack.

How remarkably the picture has changed since Gen. William Mitchell sounded the death knell of all major ships afloat and many of our supposedly impregnable ground installations with the attack of his air armadas! But it has required a quarter century of effort to take the antiaircraft artillery out of the joke columns. During that period I had a speaking part in many of the scenes as they moved on and off the stage, and some of these were interesting enough to be made of historical record as I reread them out of my notebooks and put them down here.

One of the first attempts—the very first as far as I know—to fire at air targets occurred at Sandy Hook Proving Ground in 1909 when General Dickson, then major in charge of proof and school, handed me the problem of determining the efficiency of the 3-inch field gun and carriage and of the 37-mm. gun, Model 1905, and mount against high air targets.

Balloon Targets

It was a puzzler, but the solution was obtained in this way: We had Maj. Ben Foulois of the Air Corps bring 3 large balloons and send them up on cables at the 3,500-yard target area for the 3-inch firing.

I remade the range tables from ballistic calculations to raise the trajectory as high as the balloons would go, about 2,500 feet, dug the carriage trails deep into the sand, put all the range finders to watch the balloons swinging in wide arcs across the range, and opened fire with the best shrapnel of the day. No results!

After considerable dinner-table discussion at the Brick House mess, a new type tracer projectile was produced. I bored a small hole in the base plug of the 3-inch shell, put a toothpick on the inside for a plug, filled the shell with a mixture of water and lamp black, and screwed home the plug.

Improvised Tracer

On firing, the powder gas blew in the toothpick, charged the shell like a Seltzer siphon as it left the muzzle, and squirted a black streak down the range about 2,000 yards.

By such aids and by calculating carefully the swing of the balloons, my firing squad managed to put enough shrapnel balls and cases through two

Colonel Mettler, now retired, held positions of high responsibility in the Ordnance Department for many years, some of which were: professor of ordnance and gunnery at the West Point Military Academy; military attaché in London; and commander of the Aberdeen Proving Ground, Md. He is now an active member of the A.O.A. in Florida where he is taking a particular interest in the new Florida Post.

of the targets to bring them down amid the cheers of the spectators.

With the 37-mm. at about 1,500 yards there appeared to be no results from a long string of well-aimed shots. However, on pulling down the balloon, several holes were found, all below the median line of the balloon. The gas remained above the holes and kept the balloon afloat.

Recommendations

The test produced many recommendations for better carriages, fuzes, range finders, shrapnel, and tracers and concluded that the two guns were useless against the new Wright flying machines.

During the next three years at Watervliet Arsenal I supervised the production of several long 3-inch high-velocity guns for new higher-angle mounts, in case any of these new flying machines should come along our seacoast batteries to shoot or snoop. Before I left Watervliet, 1st Lieut. Thomas O. Selfridge had been killed while learning to fly a plane, and the English Channel was the next air problem for the adventurers in the third dimension.

When World War I broke out in Europe in 1914 I was on duty in the office of the Chief of Ordnance. French aviators had flown over the battle lines and watched the advancing Germans. We were putting fins on artillery projectiles to be dropped as bombs from the airplanes. Assistant Secretary of War Breckenridge brought a German dud all the way back from France and delivered it, fuzed and loaded, into the office for our inspection! We finally got it safely to Frankford Arsenal but lost it by explosion when we tried to take it apart.

French Fire Control

When at last our troops arrived in France in 1917, the French had antiaircraft carriages and the Routin corrector to determine the set-forward point for fire at air targets. At the end of the war we brought home the French carriages and the R.A. corrector, took from our factories the 1918 model antiaircraft guns and carriages, and spent the next few years nursing them in cosmoline while we thought over the lessons of the battles.

All the firings made at the new Aberdeen Proving Ground indicated the wasteful and futile fire of the existing equipment against the rapidly improving and faster-flying planes.

After six years of intensive study by all armament designers, Maj. W. P. Wilson of the Coast Artillery brought forth the most promising design in which several cams continuously made the essential corrections in the data provided. He was promptly ordered to Frankford Arsenal and given all the help the Ordnance Department could offer. Unfortunately, he became ill before he completed his instrument and died within the year.

The Vickers Company in England had also shown us a good new design that had achieved some results for the British artillery. We obtained an early device, but when we undertook to secure the latest type, the British War Office refused permission for the sale. I was permitted to negotiate with the British attaché in Washington and succeeded in trading a Semple mechanical fuze and a lot of flashless powder of the magnesium-sulfate type for a new antiaircraft director.

Illustrated Lecture

In the meantime I had worked up a rather long and well-illustrated lecture on antiaircraft, which was delivered before the New York Ordnance District Office group and the New York Post of the American Ordnance Association at the A.S.M.E. hall in New York. I ventured to suggest that the field was open to inventors, that any good firm that would spend about $50,000 on the problem would get all the Ordnance designs and all the help that could be given, and that the Ordnance Department would purchase any instrument produced that showed promise over the types on hand.

During the handshaking, which is the pay-off for all military lecturers, Mr. Doran and Mr. Tom Morgan of the Sperry Gyroscope Company asked me to come to the Engineer Club after the session was over to discuss the proposition I had made. It was a good meeting, and a temporary agreement was reached. Maj. Gen. C. C. Williams, Chief of Ordnance, readily approved the scheme, and everything was turned over to the Sperry Company. Thus began the new era in antiaircraft fire control.

I went off to London as assistant military attaché to look after the Vickers design and to get into it as much improvement as possible. I found the manufacture was carried on in the small shop of Cooke, Troughton and Sims, hidden inside the walled city of York. I made friends with a fine lot of workers and with Mr. Percy Gray, the Vickers designer. Together we achieved some advantageous changes.

Scotch Height Finder

Going on to Glasgow, Scotland, I procured from Barr & Stroud a 4-meter-base coincidence height finder. When it was ready, I took it to York and, with a Vickers step-by-step electromagnetic transmission system, hooked it up with the Vickers director to carry the target height directly into the mechanism.

Taking this back to Aberdeen in 1927, we found by new tests many things that could be improved in all such AA mechanisms. I took the new ideas back to England after the reports were analyzed in order to get new and better directors made by Vickers.

Maj. G. M. Barnes, Ordnance Department, went back with me and together we went on to Paris to get better stereoscopic height finders from the Levallois Company there. While the negotiations were going on, one of our Engineer officers at the École de Guerre in Paris called me on the telephone to report an unusual fellow trying to sell him a high-burst ranging device for field artillery. I got the man to come to the American Embassy (then at 5 Rue de Chaillot) to show me his invention.

Mr. Popello

A Mr. Popello arrived, speaking slowly a mixture of Esthonian, French, and German, to which we replied in some French, some English, and a bit of German. At last, he opened his brief case and handed me an unopened envelope stating that it contained his design. I took it to one side while Barnes kept up the talk.

The envelope did not contain the high-burst ranging device but, instead, an unusual design of antiaircraft corrector and with it a contract from a foreign government to build a corrector in his own shop at Tallinn, Esthonia.

Early 37-mm. automatic cannon for use against aërial targets.

I handed the design to Barnes, saying rapidly, "Something new here. Take it in the other room and examine it." He soon returned with a surprised look on his face and said, "Let's buy one." I folded the design carefully, put it in its envelope and returned it myself to the brief case.

Then we turned the subject to antiaircraft fire control. Our visitor, who was found to be a professor at the University of Talinn in Esthonia, denied any knowledge of AA firing or instruments pertaining to it. We took him to lunch at the Cercle Interalliée, which I had previously joined, and fed him very sumptuously on duck and wine.

He expanded under the story telling, language difficulties grew less burdensome, and at last he admitted his antiaircraft designing. We admitted our knowledge and made a deal to get another instrument made alongside the one he had contracted for. Whether his mistake with the envelope was intentional or not, I will never know, but it was an interesting play anyhow.

Plans Approved

General Williams promptly approved our plans and sent Maj. H. H. Zornig to England and to Berlin to follow through this production and other matters in Eastern Europe.

The next summer we got Mr. Popello with his instrument to Aberdeen Proving Ground for a very interesting program of tests. The new Sperry instruments were then beginning to show promise, and much new antiaircraft information was obtained.

Visa Not Extended

Unfortunately, Mr. Popello's visa was not extended, due to poor vision in higher places, and he returned to Germany where he was promptly employed by General Becker, who later became the head of the German Research and Development Office under Hitler. There Popello improved the German instruments which were so effective against us in World War II.

Returning to London after the arrangement with Popello, Tom Morgan came over to examine the antiaircraft work being done by the Vickers Company. I had the pleasure of assisting him with introductions and information. He made some interesting arrangements with Vickers, took Percy Gray, their designer, to New York, and produced new designs for many AA devices as well as other control mechanisms.

For some years I was on field work, two of which were with the Hawaiian Department where my organizations serviced the new Sperry directors and other instruments, and I witnessed many antiaircraft practices by the newly formed antiaircraft regiments.

It was always evident that airplane speed had increased so much, the altitudes of flight had become so high, and the times within range of any fixed artillery so small that little could be accomplished to stop the air raiders in a carefully planned attack. The planes were gone before accurate fire could be established.

Pearl Harbor, 1937

Between four and five o'clock, one morning in 1937, I was sitting alone on top of the commanding general's observation post on the rim of Aliamanu Crater, watching for the Navy attack on Pearl Harbor as part of the joint maneuvers, when I suddenly realized that planes were somewhere in the high air over the Koolau Mountains. They were too high to see with the naked eye.

While I was straining to discover them, one came down through the sunlight, like Lucifer falling from Heaven, into the dark shadow of the mountains over Pearl Harbor. It leveled off over the drydocks and the oil tanks and quickly winged on over the distant Waianae Mountains out of sight. It was followed by another almost at once and then another, until eighteen planes had performed their simulated bombing and strafing missions.

Then I watched the antiaircraft batteries rushing to their posts long after the planes had all disappeared. Not a single gun had been trained on them. Not a plane had risen to intercept them. There was no radar then to tell of their approach.

Pearl Harbor, 1941

How that picture came back to me on that fateful December 7, 1941, when the Japanese planes performed the same maneuver, this time with such terrible destruction and disaster and death!

The radar and its many improvements, the proximity fuze, the automatic instruments and transmission systems, the guided missiles with their long-range possibilities, and all the atomic advances in destructive power have made obsolete all the scenery of the old performances.

However, before it is thrown away, it might be interesting to the older actors to have a last look. Even those new ones might be interested to know that such scenes were once on the stage and are the background of the things of today.

Electronic Brain

ORDVAC at Work

High-Speed Calculator Computes Theoretical Data On New Weapons

IF one hundred persons would operate desk calculators for one year, working at maximum speed and efficiency, they would accomplish an amount of work that the Ordvac can produce easily in one 8-hour shift.

This is an example of the operating speed of the Ordnance Discrete Variable Automatic Computer (Ordvac) now in use by the Computing Laboratory of the Ballistic Research Laboratories, Aberdeen Proving Ground, Md.

In one week of operation, Ordvac's creators estimate, this computer can solve a problem that would take a human, equipped with a standard desk calculator, more than 2,000 years.

Suppose now that these one hundred persons are isolated in one large building. A mathematician gives each of the hundred persons instructions at the beginning of the year. He is allowed to see the partial results of his instructions once a week to decide whether his initial orders were correct. If the results are incorrect he can have the one hundred computers start a new problem under the same rules; otherwise, the work progresses for the remainder of the year. This is the type of work that the mathematicians have to do when they prepare a problem for Ordvac.

Col. Alden P. Taber, Ordnance Corps, is director of the Ballistic Research Laboratories, Aberdeen Proving Ground, Md., and Dr. T. E. Sterne is chief of the Computing Laboratory which operates the Ordvac. The Computing Laboratory employs 155 mathematicians, electronics and mechanical engineers, physicists, computers, and scientific aids.

Cannot Think

The cited example should illustrate something else; namely, that these so-called "electronic brains" cannot think creatively at all. The Ordvac has two distinct advantages over the desk calculator: first, it is faster and, secondly, it can be given instructions so that it will work for a considerable length of time without further direction. The name "electronic brain" has been used since some of the instructions are somewhat complicated. One of them says, for instance, "If a certain computed number is positive or zero, go to the next instruction; if, however, the same computed number should be negative, follow another set of instructions." Thus, it is possible to rely on the machine to decide for itself whether it has computed its answers to sufficient accuracy. This act does not involve any "thinking," but shows that the Ordvac carries out a given set of instructions.

Accurate Memory

A leading feature of the Ordvac is its spacious and accurate memory. The memory acts as a storage house for all instructions and intermediate results. It consists of the electrostatic "Williams" type using forty 3KP1 cathode-ray tubes, similar to a small picture tube of a television set. Instead of carrying a picture on its face, it relays a big square consisting of 961 little squares. The corner of each small square is either a dash or a dot.

In this way, 1,024 pieces of information are stored on the face of one tube or 40,960 pieces of information on all 40 tubes. A slave cathode-ray tube and a 40-position switch are provided so that the contents of any one of the operating tubes can be viewed at one

time. When the Ordvac needs pieces of information, it can extract them from the tubes in 36 millionths of a second. No other computer's memory is both so large and so fast.

Small and Compact

Unlike many other electronic computers, Ordvac is small and compact—8½ feet tall and 10 feet wide. Engineers expended a great deal of effort in its design and construction to minimize the number of tubes, totaling 2,700, and the amount of other equipment required to make the units compact and accessible. A closed-cycle air-conditioning unit was installed to maintain a constant temperature of 65 degrees Fahrenheit within Ordvac. Should the air-conditioning unit fail, an alarm system automatically cuts off all power.

The Ordvac can do all computations with dashes and dots, whereas the average person has to use the numbers zero to nine for the same purpose. The reason is that the Ordvac works in the so-called "binary" system while we use the decimal system in everyday calculations. The binary system sounds like an excellent excuse for lazy students. All that is required is the ability to add, subtract, divide, and multiply by two, and any one can duplicate the Ordvac for a while, provided one lives long enough to do so.

6,000 Orders a Minute

The number capacity for Ordvac is 40 binary digits, which is practically equivalent to 13 places of decimals. It can handle, on the average, about 6,000 orders per second. The amount of time required for an order to be executed depends upon the order, but the following speeds are illustrative. These include the time to obtain the operands from the memory and to place the answer back in the memory if numbers are needed.

	Millionths of a Second
Addition and subtraction	120
Multiplication	1,000
Division	1,000
Shift a number one place	15

A simple multiplication would proceed somewhat like this: suppose you want to multiply twelve by fourteen. In one column you write the multiplicand and divide it by two, then divide the quotient by two, etc., always leaving off the fractional part. Finally you end up with one. In the other column you write just the multiplier, then double the product, etc., until the position opposite the one of the first column is occupied.

12	14
6	28
3	56
1	112

If there is an odd number in the first column add the corresponding numbers in the second column. This is the result. In our case 56 plus 112 leads to the correct result of 168.

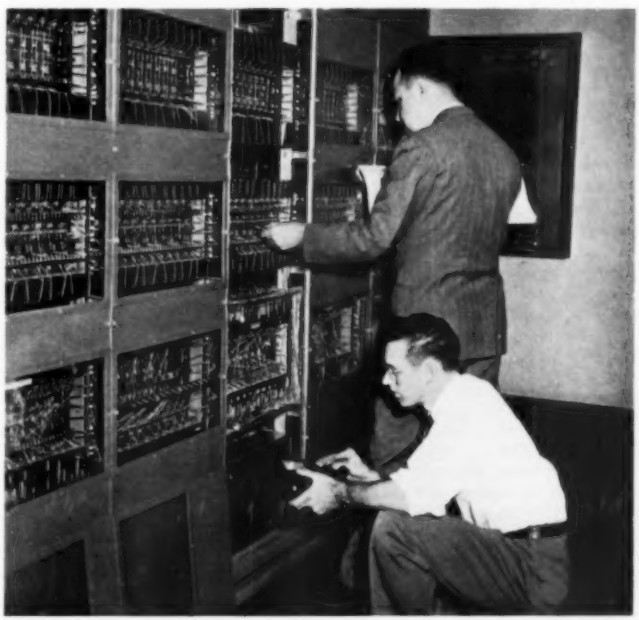
The Binary System

One might ask, "Why does the Ordvac use the binary system for storage of numbers?" The answer is very simple: The binary system uses only two different states to represent one digit of a number. One such state, like a dot in the memory, represents a one, while a dash on the face of a cathode-ray tube indicates a zero. While it would be quite simple to store more complicated patterns on the faces of these memory tubes, the other parts of the machine can assume essentially only two states. They consist of so-called "flip-flops."

Two States

These devices are capable of being in two different states. In addition they can be changed from one state into the other within one millionth of a second. This is the reason why they are applied in Ordvac. When the Ordvac was built, it was decided to use the binary system in order to gain speed. Furthermore, the mathematicians do not find it difficult to work with the binary system.

The input-output equipment consists of modified teletype units of the kind which were developed by the Bureau of Standards. It operates at standard 5-hole teletype tape of which four holes are used to represent numbers in the sexadecimal or base-16 number system by means of a binary code. Output from the machine can be either to a tape punch or to a teletypewriter. This is in the sexadecimal system. However, if it is desired, the output can be programmed and converted by means



Technicians at the Computing Laboratory are shown, above, making a routine check of Ordvac's electronic components before giving the "brain" a new problem.

of a simple routine to decimal quantities.

The use of teletype tape for input-output has one advantage over the punched-card input-output system. Since the Ordvac uses standard 5-channel teletype tape, it is possible to send coded problems to Aberdeen by way of the commercial teletype means. A program to train outside personnel in coding for the Ordvac has been started. It is very likely that in the future, several commercial and Government groups outside of the Aberdeen Proving Ground area will be coding problems for the Ordvac. The tapes will then be transmitted to Aberdeen by teletype. The "code-checking routine" permits the recording of every step in a computation, and the results of such a test run can then be sent back to the sponsor of the problem for examination and correction of possible "coding errors."

Quick Results

In this way it is possible for a research crew to obtain useful results very quickly even though they are several thousand miles from Aberdeen Proving Ground. One might say, "The Ordvac can be used conveniently by any group having a teletype outlet at its disposal."

The input and output are slow. Ordvac accomplishes its mathematical problems much faster than it can report them. For instance, it could calculate the cubes of some 2,000 numbers in a few seconds, but it takes an hour and ten minutes to write the answers on an electrically operated typewriter. The staff of the Computing Laboratory hopes to speed up this operation by using modified International Business Machines Corporation punch-card input-output units. This additional equipment is being installed.

Number of Steps

In order to make the Ordvac solve a problem, quite a number of steps have to be taken before the machine will begin to operate. First, mathematicians have to reduce all computations to a sequence of the four basic operations: addition, subtraction, multiplication, and division. Then another complication has to be considered. The Ordvac can only handle numbers between minus one and plus one. Therefore, all intermediate and final results have to be in fractional form. This so-called "scaling of a problem" requires in many cases a considerable amount of insight into the problem on the part of the mathematician.

Next, the instructions to the machine have to be worked out and punched on a commercial teletype tape. This tape is then read through a reader and instructions are transferred to the Ordvac memory. The machine is then ready to start following these instructions.

"It is difficult for most people to understand the types of problems that require such a vast amount of computation. However, many improvements in modern warfare are accepted only on the basis of results evaluated by many elaborate mathematical calculations. . . By computing theoretical data while a missile is still on the drawing board, it is possible to make improvements with large savings resulting for every taxpayer."

Even though great care is taken to avoid errors in writing down instructions and punching the tape, there are usually about one or two errors that appear on it. However, the mathematicians at the Ballistic Research Laboratory have devised the so-called "code checking routine"—a special program by which the machine checks its own instructions. Thus it is possible to find these errors in a short time.

Installed Recently

The Ordvac was installed in the Computing Laboratory of the Ballistic Research Laboratories in February 1952. It was built for the Army by the University of Illinois from blueprints made for a similar machine at the Institute for Advanced Study in Princeton. After preliminary acceptance, the Ordvac was crated, shipped by truck to Aberdeen, reassembled, and finally accepted within two weeks. This is a remarkable feat considering the fact that the Ordvac contains 2,700* miniature vacuum tubes of the type used in car radios and many other commercial products.

It is also difficult for most people, with the exception of mathematicians, to understand the types of problems that require such a vast amount of computation. However, many improvements in modern warfare are accepted only on the basis of results evaluated by many elaborate mathematical calculations.

Ballistic Research

Naturally the Ballistic Research Laboratories are concerned with research in ballistics. Thus the Ordvac will spend most of its time computing trajectories of missiles, bombing tables, air-flow and heat-transfer problems, firing tables, stress analysis of complicated structures, weapons systems evaluations, etc. By computing theoretical data while a missile is still on the drawing board, it is possible to make improvements with large savings resulting for the Army, and, of course, for every taxpayer.

While it is possible to have a missile explode within or very close to an airplane, there are only a limited number of vulnerable targets in a modern plane. Usually in case of larger aircraft the loss of one pilot will not keep the plane from performing its mission. It is very important to know how many missiles have to explode close to the plane in order to make a "kill" possible. The Ordvac can simulate the effect of such an explosion on the plane and its crew. By choosing the location of the burst at random, that is to say, depending on random numbers, an estimate of the probability of a "kill" could be computed without actually firing a missile, with the accompanying cost in time and money.

The Ordvac is not the only high-speed computing machine at Aberdeen Proving Ground. Two other high-speed electronic computers, the Eniac and Edvac, make the Aberdeen computing facilities the largest in the world. The Eniac is the first large high-speed electronic digital computer in the world.

Facilities Enhanced

The recent addition of the Ordvac has greatly enhanced the computing facilities at Aberdeen Proving Ground and has placed it in the enviable position of being one of the most modern and best-equipped laboratories of its kind in the world.

*This number is small in comparison with the Eniac which has approximately 19,000.

"Detroit on the Isar"

Rebuilding Engines at the Karlsfeld Ordnance Depot

by

Maj. Fred P. Dyhrmann

Headquarters Staff, Karlsfeld Ordnance Depot

Thousands of tank, jeep, and truck engines have come off its production lines since Army Ordnance began operations there in 1945

THE Karlsfeld Ordnance Depot, located between Munich and Dachau, is not only the most unusual tank-automotive rebuild shop in the world but the largest and hence is known among Ordnancemen as "Detroit on the Isar."

Not much is known about this "Bavarian Willow Run" by the casual driver traveling between Munich and Dachau except that it exists. However, within its fenced-in 273 acres the most feverish activity is going on all day long.

Captured by U. S.

Built in 1938, the plant expanded during the war years and up until April 1945, when it was captured by the Americans, turned out an average of 600 aircraft engines each month for the German Air Force.

Ironically enough, it was on July 4, 1945, that the first U.S. Army Ordnance troops moved into Karlsfeld and began operations. Since then the depot has become the largest tank-automotive rebuild shop in the world, producing thousands of engines and power-train assemblies. In June 1951 the 135,000th rebuilt engine came off its assembly lines, including the 50,000th jeep engine and the 60,000th GMC engine. More have been rebuilt since then, and more will be rebuilt in the coming months.

At present there are over 6,000 German nationals, displaced persons, and refugees at KOD. To assist the commanding officer and to carry out his directives and policies there is a staff of 26 civilians, 25 officers, and 19 enlisted men. Together they make up the 7840th Ordnance Depot Detachment, and Headquarters and Headquarters Detachment, 84th Ordnance Battalion.

The entire Ordnance Corps takes in four groups: ammunition, supply, maintenance, and procurement. The KOD falls under the maintenance group, even though some supply men are attached and assigned to the depot. This group is responsible for supplying the European Command with the various engine and power-train units assembled at the depot.

Six Divisions

The operation of the depot is broken down into six divisions, all of which are headed by more-than-capable officers and civilians. They are the engineering and inspection division, purchasing division, control and planning divi-

sion, stock-control division, storage division, depot-facilities division, and the management office.

Large Acreage

Of the 273 acres of the depot, 243 are in operational use for supply, storage, and industrial operations. Shop space, including rebuild lines, tools and parts manufacturing, and reclamation area totals 917,225 square feet. There is an area of 519,150 square feet of gross covered storage space and 3,054,534 square feet of gross open storage space.

The concrete bunker, a huge structure with walls and roof of heavy reenforced concrete 11½ feet thick and extending deep into the ground, was built by the wartime owners as part of a desperate "last-ditch" plan to move everything underground.

There are two power stations, only one of which operates. This one, however, generates sufficient electric power and steam both to heat and light the entire plant. The power plant requires five trainloads of coal a day. Maintenance of the 9 miles of road, 7½ miles of railroad, and 80 buildings is a full-time job for 42 employees.

Mass Production

The success of the Karlsfeld Ordnance Depot as a major rebuild center derives on the one side from successful adoption of mass-production methods for the complete rebuilding of all types of Army engine and power-train units and on the other side from the successful education of the Western German manufacturers to mass-produce spare parts with U.S. dimensions, threads, and, in many cases, U.S. material specifications.

There are three main structures in which most of the rebuilding is carried on. In one building an assembly line reclaims parts which have been stored for years at KOD for such a purpose. Here every conceivable method is used to restore the parts to their maximum efficiency. Crankcases, engine blocks, pistons, etc., all undergo practically the same process.

After being unpacked from their wartime cratings the parts are cleaned by acid and in some cases by sand blasting. They are then packed in the required degree of preservative and repacked for shipment or for use on the engine or power-train assembly lines.

The engine rebuilding is carried on in the second of the three main buildings. Here engines from all over the Command are gathered, inspected, and run through one of three main rebuild lines.

The procedure in each of these lines is essentially the same. The engine block, stripped of its accessories, is run through a chemical wash machine. The block is then completely disassembled, with shafts, valve guides, pistons, etc., being routed through cleaning, inspection, and reclamation and then to the final assembly line. The stripped block is cleaned, tested for cracks or other defects, and rebored. Crankshafts are straightened and reground.

"The success of the Karlsfeld Ordnance Depot as a major rebuild center derives on the one side from successful adoption of mass-production methods for the complete rebuilding of all types of Army engine and power-train units and on the other side from the successful education of the Western German manufacturers to mass-produce spare parts with U.S. dimensions, threads, and, in many cases, U.S. material specifications."

The assembly process then begins. Pistons, rings, and connecting rods are carefully checked in sets and assembled. The other parts and accessories are assembled at stations in an orderly sequence down the line. Then the final inspection for completeness is made.

Engines Tested

The engine is given a comprehensive test run on a dynamometer test stand. Any defects discovered are carefully noted, and all defective engines are returned to a special section for correction and then retested.

Engines which pass the tests are painted, preserved, and packed for long-term storage in specially constructed reusable containers which are also made at KOD. They are then turned over to the Supply Group and issued to using units.

The power-train rebuild shop operates under the same assembly-line action but with each type of power train being processed on a separate line. The unserviceable units are steam-cleaned, partially disassembled, drained, and given a thorough steam and chemical cleaning before being rebuilt. These, like the engines, are also tested, painted, preserved, boxed, and finally delivered to the units.

Huge Savings

The saving in dollars is tremendous. In the reclamation branch alone a saving of $740,000 was realized over an 8-month period. A quick look at the figures shows that for $6.50 KOD can reclaim a jeep crankshaft that would cost $24.57 new. A new jeep cylinder block costs $127.34, while KOD reclaims it for $1.60.

This particular type of reclamation is done by a metalization process, and KOD has the largest metalization shop in EUCOM. In all there are 1,200 approved methods and separate procedures for parts reclaiming at KOD.

Karlsfeld is proud of its absentee rate. The average rate in German industry is 5 per cent, but KOD boasts a rate of only 3.7 per cent.

There is little doubt as to the efficiency of KOD. In its last annual inspection it received an "excellent" rating, with no major deficiencies reported. In the last two EUCOM Ordnance technical inspections, KOD has been rated "superior."

Unusual Installation

Naturally, all this has focused a lot of attention on KOD. The installation is so unusual that inspectors from the U.S.—and from most Allied countries—have visited it to view its unique methods of operation. And little wonder, too, for it can stand as an excellent example of Ordnance conservation and efficiency the world over.

In a series of three articles appearing in the September-October and November-December 1951 and the January-February 1952 issues of ORDNANCE, Brig. Gen. Gerson K. Heiss, Ordnance Officer of the Japan Logistical Command, described how "Operation Roll-Up" collected from the Pacific Islands 63,000 automotive vehicles which were subsequently processed and rehabilitated in Japan and formed a large part of the United Nations support in Korea.—THE EDITORS.

Simmons switches to TIMKEN® bearings, gets more accuracy in 6" boring and facing machine

WHEN the Simmons Machine Tool Corporation redesigned their old, plain bearing 6" horizontal boring and facing machine they wanted it to work to the closer tolerances required today.

To insure the spindle rigidity which would make accurate machining possible, Simmons engineers mounted the machine's boring bar sleeve spindle on Timken® precision bearings. Timken bearings are also used in the following applications: boring bar steady rest, saddle feed assembly, worm gear shaft, feed sprocket shaft, input shaft, first and second intermediate shafts.

Timken precision bearings are made specifically for precision spindle applications. "Double Zero" bearings are available with run-out tolerances of 75 millionths of an inch or less.

Because of their tapered design, Timken bearings permit pre-loading to any desired degree, preventing chatter. Because of line contact between Timken bearing rollers and races, there's more than enough capacity for any tool load.

Timken bearings reduce machine tool manufacturing costs too. Assembly and set-up of the bearings are quick and easy. No special thrust bearings are needed.

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This symbol on a product means its bearings are the best.

SIMMONS MACHINE TOOL CORPORATION mounts the boring bar sleeve spindle and eight other vital parts of their 6" boring and facing machine on Timken tapered roller bearings.

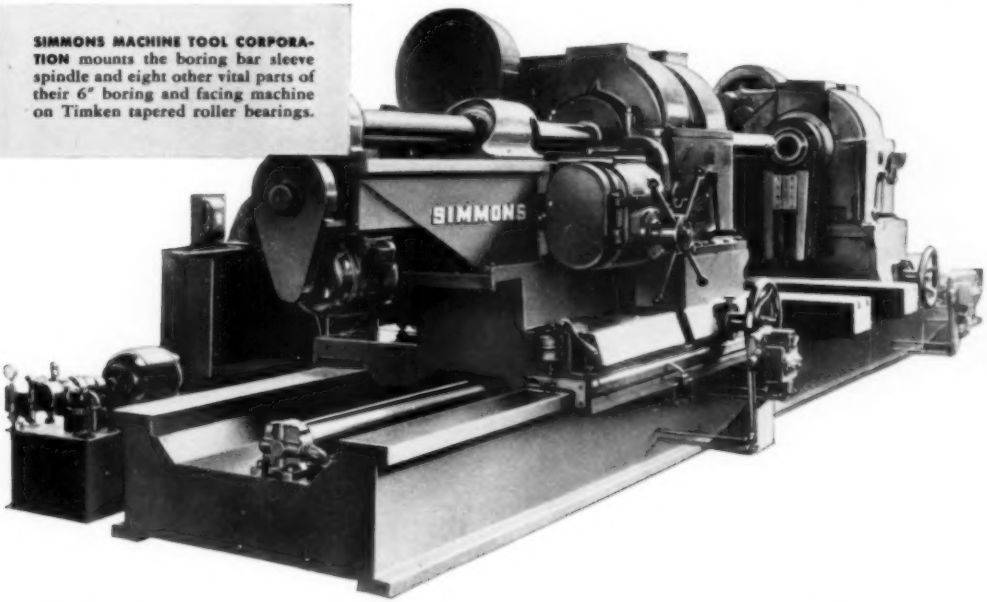

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Photo by Helen Fischer, *courtesy of* Field and Stream

Curtains for Felis Concolor

Felis concolor, the puma, also known as the mountain lion or cougar, is a perfect deer-killing machine. He stalks his prey silently, slipping through the grass and brush, then springs on his victim's neck or shoulders. Here's a big cat who'll lead the hounds on a day-long chase over the roughest kind of country . . . and fight like blazes when cornered.

You'll get a kick out of ringing down the curtain on the puma when he's killing too many deer, or is slaughtering livestock. However, he does help preserve the balance of nature by killing off weaklings and cripples. So be sure to check your local game regulations before shooting the puma.

Besides controlling predators like the puma, good sportsmen can help conserve our game supplies by joining and supporting local and national conservation groups.

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